BIKE REPAIR & MAINTENANCE

UPDATED EDITION

ROAD & OFF-ROAD

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FROM THE MAKERS OF

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CYCLING PLUS

HOW TO: SERVICE ROAD DISC BRAKES ◎ TUNE MTB SUSPENSION ◎ TRUE WHEELS
SERVICE A DROPPER POST ◎ SORT YOUR SHIFTING ◎ STOP SQUEAKS ◎ MUCH MORE...

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WELCOME

There are few simple pleasures as enjoyable as riding a bicycle that almost effortlessly and silently glides along, free from annoying squeaks, creaks and grinds. Unfortunately, actually riding your bike exposes it to weather, grime and wear, so keeping it in tip-top condition takes varying degrees of knowledge, skill and time. One solution is to entrust your bike to the mechanics at your local bike shop. However, workshop costs can quickly mount up. The other way to look after your steed is to do it yourself of course, which is where this mag comes in.

If you're reading this, the chances are that you are the sort of person who wants to acquire the skills and knowledge necessary to maintain your own bicycle, or perhaps you're looking to add new skills to your already burgeoning workshop knowledge base.

From fixing a puncture to building a wheel, inside this special edition you'll find mechanical tips, tricks and techniques from our team of bicycle maintenance experts to help you to maintain, fix and upgrade your bike whatever your skill and experience level.

From hardlearned experience, the best advice we can offer to help avoid serious problems occuring out on the trails or roads is to regularly clean and lube your bike, and be watchful for the first signs of any issues so you can nip them in the bud – there's lots of advice on all of this inside too.

Care for your bike and it will pay you back many times over.

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BEGINNER EXPERIENCED EXPERT

£100 to £200 for tools and equipment

WORKSHOP SAFETY

Fixing your bike is great, so long as you don't break yourself or your bike on the way.

Ok, we know you can't wait to get stuck in with the spanners, tuning your bike up from a squeaky shopper into a slick speed machine to turn the eye of the most extravagantly equipped pro. Or at least make it a less squeaky shopping bike!

Before you start though, take in these tips on how to fix things without 'fixing' yourself good and proper, or repairing one bit of your bike while causing damage to another in the process, with slipped spanners and the like.

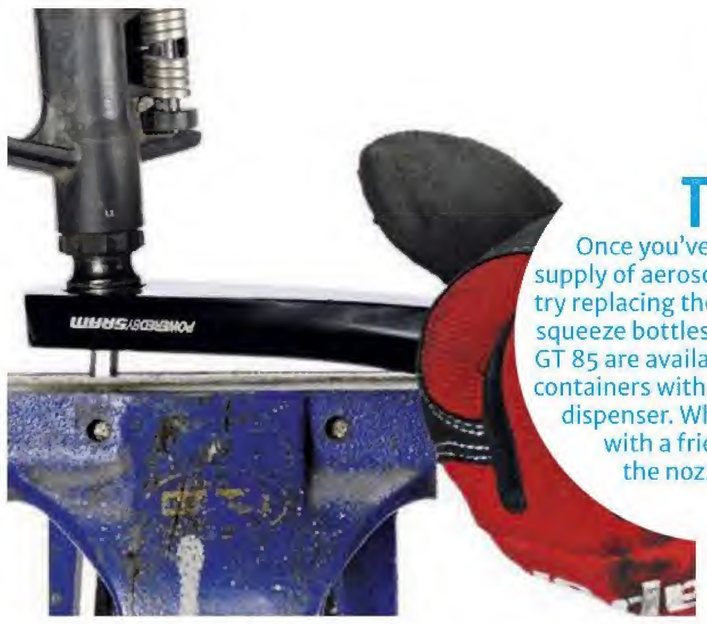
We're not advocating that you cosset yourself in cotton wool. We're just trying to make sure that when you're done working on your bike, you're still 100% fit to ride and enjoy it. Whether you're a battle-hardened workshop warrior or a newbie DIY dilettante, this guide is worth a read.

1 WEAR GLOVES

Put 'em on! Snap-on gloves, as pictured, or similar, are a hit with car mechanics. They're really effective at preventing painful skinned knuckles and more insidious repetitive strain injuries to the nerves running inside your palm, incurred from years of wrenching away on hard-edged tools with poorly designed handles. They also protect the vulnerable insides of your wrists, where all the delicate bits converge. Years of exposure to solvents and oils can lead to increased skin sensitivity, rashes and premature ageing. Use thin rubber gloves where possible. Also, constantly washing greasy hands with harsh soap is no fun, so use a good barrier cream at all times. Almost all consist of a skin-friendly paraffin that washes off with warm water, taking the grease away with it.

5 FIXED GEAR FINGER JAM

When a bike is hanging on a stand, the normal state of affairs is that the pedals, cranks and rear wheel are whirling away as you make multiple small adjustments. Perhaps you're trying to re-install a dropped chain, or maybe truing the wheel between the brake blocks, using your hands to slow the wheel down. Or you might just be messing around, trying to find out just how fast you can get that fixie spinning... While it's certainly fun, our advice is DON'T, or certainly be really careful! With a multispeed hub or singlespeed freewheel, you can stop things a little quicker, but it's still wise to avoid spinning the wheel backwards while your fingers are anywhere near the chainring or cog. On a fixed, the consequences could definitely be more drastic: there's so much momentum and no slack.

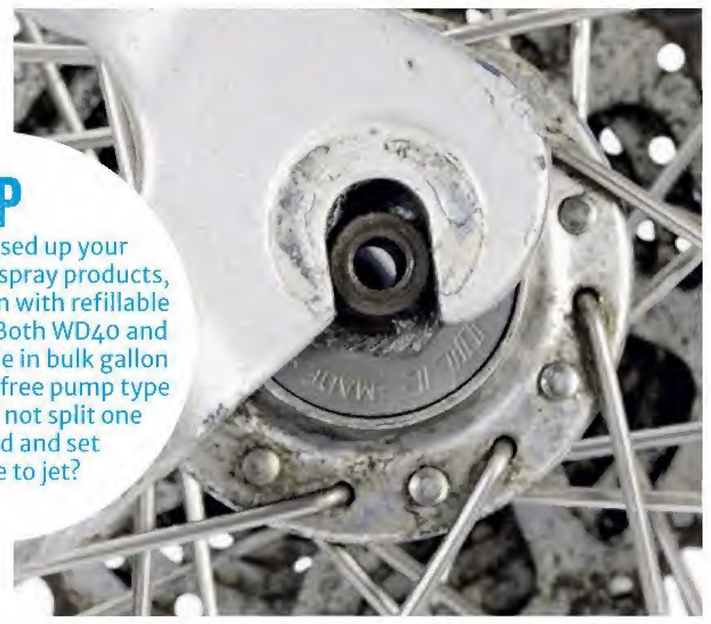


6 ADJUST ACCORDINGLY

A frequent way of inflicting damage to your beloved bike is by not understanding how the fastening or adjusting method works. Always read the instructions first, or consult the appropriate literature. The two most common cases tend to be self-extracting crank arms and headset adjustments, which are still a mystery to a lot of cyclists. When removing the former, as in some Truvativ models as pictured (and FSA), make sure that the outer extractor ring is engaged in the crank arm before applying force to the main removal bolt. Take the same precaution when using a separate extractor on a square-tapered arm. In the latter case, always remember to loosen the steerer clamp first on threadless headset stems before tightening the top cap adjuster bolt. Then re-tighten the stem while respecting the correct torque.

TIP

Once you've used up your supply of aerosol spray products, try replacing them with refillable squeeze bottles. Both WD40 and GT 85 are available in bulk gallon containers with a free pump type dispenser. Why not split one with a friend and set the nozzle to jet?



7 WHEELING AND DEALING

A frequently seen problem in many years working on the frontline is recalcitrant wheels not properly seated in troublesome dropouts. For a variety of reasons, they can sometimes sit off-kilter; this is usually due to maybe a bit of extra paint, chrome or resin coating the axle seat or, in some instances, a dropout that's slightly closed up from having been dropped (this is pretty easy to do on a front fork). Before tightening the wheel, give the bike a little downward slam to help 'persuade' the wheels into their correct position. Carelessness is also a frequent culprit; avoid at all costs tightening the skewer over the lawyer tabs (small safety protrusions) on front dropouts. It'll make them bent and dangerous, and losing a front wheel when you're hurtling down a hill can bring on a whole world of hurt.

- ✓ Gloves
- ✓ Mask
- ✓ Goggles
- ✓ Pointed drift punch
- ✓ Bench vice
- ✓ Torque wrench

WORKSHOP WISDOM

The trusty old bench vice can be invaluable when you're wanting to achieve good ergonomics and need to really put some force into loosening a tight component. The added leverage and upright position enable you to stay in complete control all the time.

2 PROTECT YOUR LUNGS

Recent research revealed potential asbestos-like behaviour of long carbon nanotube fibres in laboratory animals, and a move in 2006 to classify as a likely carcinogen a chemical (known as C-8 or PFOA) used in the manufacture of non-stick products such as Teflon/PTFE suggests you can never be too careful. Wear an up-to-date mask with an AB1 and P2 filter for very fine dusts, fibres, fumes and aqueous mists. Innocuous everyday products like spray lubes and by-products like carbon fibre dust from cutting steerer tubes or handlebars can, over time, become respiratory sensitisers, inducing asthma-like reactions in susceptible people. More serious effects are as yet unknown, and while we await the verdicts of ongoing research – which could take decades – play it safe.

3 LOOK AFTER YOUR EYES

Don't gamble with what are probably your most important sensory assets. Hazards to sight, such as spray lube splashes or flying oil, can be sudden and catch you off guard; a rim failure or tyre blowout can be a very unpleasant surprise when you're not ready for it. Keep your face away from the tyre at all times during inflation. If the bike is raised with the wheels at chest level and you're using a compressor, you're more likely to have your face closer to the hazard zone. Be particularly careful with reinforced sidewall tyres such as Armadillos, or if the bike has been in storage for any length of time, meaning possible perished rubber. Finally, if you're having a stab at truing a high tensioned wheel – or even a normal one – you might as well put your goggles on. What have you got to lose?

4 DANGEROUS TORQUE

The exponential progress occurring in certain fields such as electronics and computing is being echoed in the cycling industry, with advanced materials developed in other fields cross-pollinating bicycle and component production. The race to produce an ever lighter bicycle has reduced certain margins of error that existed when bike bits had extra metal on them. You can no longer just tighten up a stem bolt or seat clamp bolt like there's no tomorrow, as some can be pretty fragile, requiring as little as 4 or 5Nm. If you're unsure about judging torque, hold a 1kg bag of sugar and lift from your elbow. The effort represents about 2ft/lbs of force: 1ft/lb = 1.355Nm, and 1Nm = 0.7375ft/lb. Better yet, get a torque wrench!

8 BEAT BLOWOUTS

Tyre placement and seating is critical, as you might imagine. The best technique for inflating a tyre, especially one that's giving you a particularly hard time, is to lay the wheel flat on the ground, so as to minimise the risk of the bead being positioned off-centre on the rim, which could lead to a dangerous blowout. Make sure you push the valve way up into the tyre, to prevent the tube from being pinched between the bead and rim. Another common danger you need to be aware of is excessive wear of the rim braking surfaces. A noticeably concave or outwardly flexed rim flange, especially at high pressure, is a surefire sign that it could be ready to fail. When it does, it can be pretty violent. Pay attention to wear indicators on rims that have them – usually a thin groove that disappears when the rim is in need of replacement.

TIP

The Health and Safety Executive has an excellent website relating to hazards and how to protect yourself against them. See www.hse.gov.uk for details.

9 FEAR-FREE FREEWHEELS

Trying to loosen a damaged freewheel on that fixie conversion project you've finally started to tackle is fraught with knuckle-damaging potential. Step forward the handy bench vice: the pawl seat flats allow the jaws to gain a decent purchase on the freewheel core. But to get to the core, you need to first dismantle the mechanism by unthreading the external bearing cone. This is best done with a pointed drift punch: place the tip in one of the pin spanner holes at an angle that'll impart a clockwise rotation (they're always reverse threaded), and strike sharply several times until it breaks loose. Unthread completely and the entire freewheel internals will come apart, exposing the pawls and springs which can then be removed. Once clamped on the exposed flats, you should be able to break it loose using the leverage of the wheel.

10 SAFE AND LOOSE

Safe tightening and loosening techniques are completely dependent on good ergonomics. You need to position yourself in such a way that if, for example, that stubborn pedal thread suddenly breaks loose, you don't lose your balance and fall, or strike your hand or knuckles against something sharp like an exposed chainring. A face plant in a crowded workshop always hurts. Also, think about using your vice for help: rather than trying to dislodge a tight bottom bracket with the bike upright or held by a wobbling workstand, remove the wheels and use the frame as the lever, with the appropriate tool clamped in the vice jaws. Pay attention to the thread direction. If you're trying to dislodge a fixed cup, secure it by applying downward pressure while holding the frame level, and turn clockwise.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

£12 for grease and oil

WHAT NOT TO DO!

Keen to try a bit of DIY but worried your 'can do' approach might end up as one big can Doh!? Here are our top 10 tips for staying out of trouble in your workshop

We all know that before you start playing around with your bike you should have a 'to do' list in your head. This should cover what to fettle, how to work safely and which tools to use. But a list of things not to do is just as important when it comes to getting the job done properly. Here are the 10 things you should try to seriously avoid doing.They're arranged in no particular order but succumbing to any one of them could put your or (even worse!) your beloved machine out of action for some time, so respect them!

This guide should help you stay out of trouble as a do-it-yourselfer. But to boost your confidence why not take a course in bike maintenance? London's Cycle Systems Academy offers state-of-the-art workshops. For more details see www.cycle-systems-academy.co.uk or call 020 7608 2577.

1 TORQUE IT OVER

Don't over-tighten fragile bolts. In this day and age of lightweight carbon components and puny 5mm titanium Allen bolts, it's definitely worth developing a sensitive touch when tightening things up. Consider investing in a decent torque wrench set with the appropriate Torx and Allen sockets; 10Nm ain't much, and 5Nm is even less, which is now often the recommended torque range for seatpost, steerer and bar clamps. Always grease the threads and bases of the bolts first, including both sides of the washers. On twin-bolt set-ups, nip each one up gradually, holding the tool with your fingertips. Stick to short handled tools and never use a cheater bar extension, or grab a fistful of Allen key and go for it because things will break.

5 KNUCKLE UNDER

Don't give in to the pressure of rushing things and get injured in the process. When tightening and loosening any type of firm thread, be aware of where you've positioned your hands and what your knuckles might strike if the tool or thread were to suddenly break loose. With a tight crank arm bolt or pedal, as pictured, always place the chain onto the big ring first to cover the teeth, which can inflict very nasty injuries if struck at full force. Consider wearing some protective gloves or simply use your riding mitts for busting tough threads loose. Never hurry. Try to position your body so you always pull towards you with your arm rather than pushing with your body weight, for better control if the threads suddenly give way.

6 LAST POST

Don't leave your seatpost in the bike forever – forever means three to six months. A seized post will make it impossible to change saddle height or to sell your bike without getting it repaired at considerable cost. Even if it's been greased, over time the grease will break down and eventually allow oxidation to occur, as it's virtually impossible to prevent moisture from entering the frame. Not only will metal seatposts and frames seize, so will carbon ones, even when both the seatpost and frame are carbon. With metal, a generous dollop of grease or copper slip should be applied to the areas of contact after cleaning and ensuring everything is grit-free. For carbon, use an assembly-paste formula such as Finish Line or Pace.

7 WELD-TIGHT

Don't put pedals in dry and too tight. Installing pedals dry is sure to cause headaches later on when you want to remove them. Over-tighten them as well and it will probably mean a visit to your local bike shop and about £20 labour or more, as the crank will often have to be removed and clamped in a vice in order to get a safe purchase on the pedal. In addition, once corrosion has been allowed to become established and 'weld' the pedal threads together, those threads can become brittle and crumble when the pedal is removed. So, plenty of grease, a protective washer when required (if the pedal axle has flats only – with no protective flange abutting the crank arm), and firmly tight, without overdoing it (30Nm or around 25ft/lb).

- ✓ Spoke key
- ✓ Grease
- ✓ Oil
- ✓ 3, 4, 5mm Allen keys
- ✓ Chain tool/measuring tool
- ✓ Pressure gauge/pump
- ✓ Torque wrench
- ✓ Pedal spanner

2 MALADROIT MECHANIX

Learn how to adjust your headset correctly and understand how it actually works. First, never tighten the top cap without loosening the stem bolts, because you'll simply damage the cap and star-washer or expander wedge located inside the steerer-tube; at the very least, the wedge will pull up level with the top of the steerer-tube and prevent further adjustment. If this is the case, re-position the wedge back down a good 1/2in/2cm. Next, make sure the top of the stem or a spacer protrudes about 5mm above the steerer edge. Place the cap on top and nip up the adjuster bolt, as pictured, but without the Neanderthal grip. There should be no bearing play, but free movement. Refer to step 1 for tightening the stem.

3 TENSION HEADACHE

Don't just true your wheel by only tightening spokes. A common error is to attempt a wheel true without fully understanding the process and consequences. Of course, the only way to learn is to try it yourself, so have a go, but only after arming yourself with as much information as possible. In the case of wheel truing, obviously the first port of call will be to attempt to remove any left and right movement. One revolution of the non-driveside spoke nipples has about twice the effect laterally as one revolution of a driveside nipple. So to keep spoke tension from ramping up excessively, split any lateral adjustments by tightening one side a bit, while loosening the other side a bit. If you're deforming nipples, you've gone way too far.

4 POINT BRAKE

Don't ignore wear limits on rims. The consequences could literally be lethal. Many rim manufacturers today will provide some sort of wear gauge – a shallow groove running along the circumference of the braking surface or small shallow holes drilled at strategic locations, usually indicated with a sticker. Find these markers and inspect them regularly. Once they disappear, the rim needs to be replaced. Another clue is a distinctly concave braking surface. If there are no wear indicators, measure the wall thickness by placing a small length of 2mm cut spoke ends on either side of the rim wall and measure across with a vernier calliper. A total of 5mm means you have 1mm of wall thickness. Anything below 1mm should be replaced immediately.

8 PS: PSI

Don't ignore tyre pressure. Riding around with soft tyres can open up a can of worms, full of inconvenience, as well as dragging down your spirit and top speed. Always check your tyres before heading out on a ride; some thinner walled inner tubes can lose between 5 and 20psi a day. Either give them a squeeze by applying firm pressure to the top with your thumb or ping them with a firm flick of the finger. They should produce a drum-like hollow sound and feel very firm when at the correct pressure. Use a good floor pump with an accurate gauge to get the correct inflation, then learn to identify by feel when you've reached that correct pressure, for those times you'll be using your hand pump by the roadside.

9 HURT LOCKER

Don't ride with your wheels loose. Lock down your quick releases before every ride and prevent a world of hurt. A common mistake is to treat the quick release as a wing nut by winding up the lever. To make matters more confusing, DT skewers, along with some aftermarket anti-theft types, actually use this method to fix the wheel into the fork. Only use that method for those particular brands. With all others, the cam action of a traditional quick release is still the only secure locking method, and will be best at preventing your wheel from getting wrenched out of the bike when put under sudden extreme loads. Adjust the skewer nut to allow the lever and cam to swing past top dead centre and firmly into the closed position.

10 CHAIN SMOKER

Don't ride with a badly installed chain. Many manufacturers as well as home mechanics will damage a chain while installing it and leave it on in the false hope that it will hold up during 'normal use'. This is wishful thinking as most chains usually endure nothing but abnormal use during their short lives. Assume that any damage, as pictured above, will always lead to catastrophic failure and possibly injury. Follow joining pin instructions to the letter, or consider using a universal joining link, which are available for most chains. Furthermore, don't neglect chain wear. A worn chain leads to early and uneven cog and chainring wear, so use a chain measuring tool to check periodically and save yourself having to fork out for a new cassette.

ROAD
OFF-ROAD

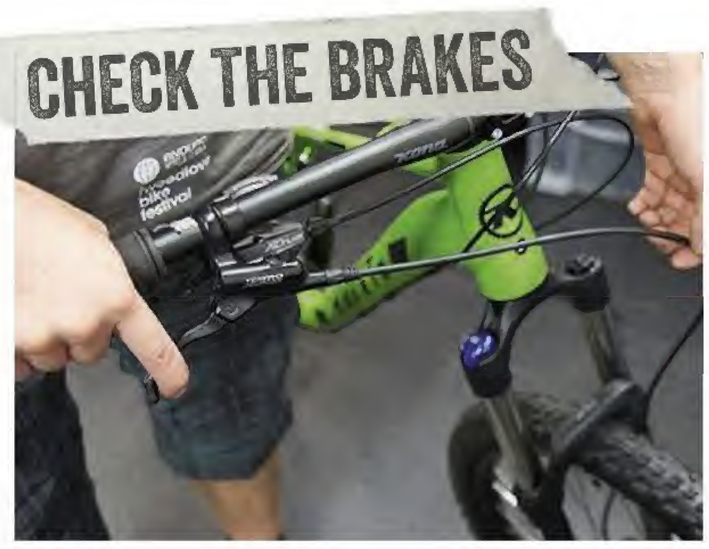
BEGINNER EXPERIENCED EXPERT

10 mins

Free

BASIC PRE-RIDE SAFETY CHECKS

Follow these four simple procedures to make sure your bike is ready and safe to ride



1A BRAKE ORIENTATION

If your bike is box fresh or borrowed it's worth quickly checking that the brakes are your preferred way round. In the UK, we usually run our front brakes on the right. Check that the right-hand lever is connected to the front calliper and the left-hand lever to the rear calliper.

1E PAD WEAR

Check the brake pads for wear if the brakes are squealing or lacking in power, or you haven't checked for a few rides. With the wheel removed, look down through the calliper. There should be some pad material protruding past the flat springs that push the pads against the pistons.

2A DIGITAL PRESSURE GAUGE

Remove the valve cap. On Presta valves, unscrew the valve head (anticlockwise). Push your digital gauge onto the valve, then remove it to take a reading. If the pressure is low, pump the tyre up harder than necessary, take another reading, then release air using the bleed button on the gauge until the pressure is correct.

2B TRACK PUMP

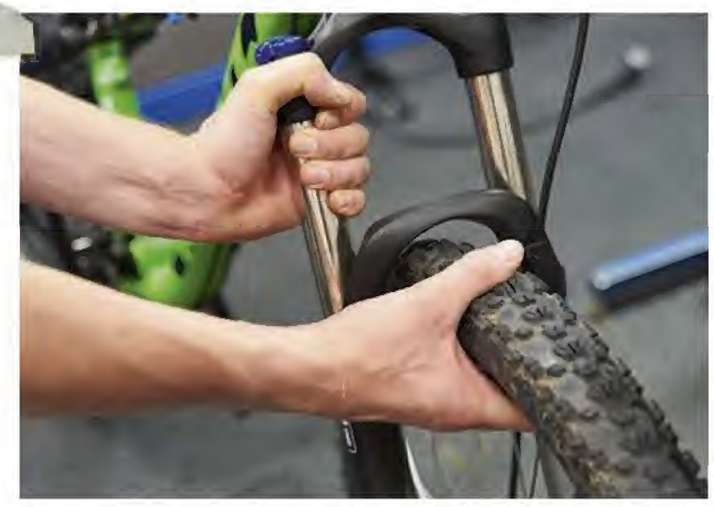
If you don't have a digital pressure gauge, a track pump with a gauge will provide a consistent – if less accurate – reading. Simply attach the pump head to the valve and pump until the desired pressure is reached (see the Workshop Wisdom box above for some pressure recommendations).

3C PRECISE SHIFTING

Go for a quick ride somewhere traffic free. Shift through the gears, making sure each change is nice and precise. If not, see pages 14 and 15 to guide you through getting your shifting sorted.

4A QUICK-RELEASE LEVERS

Make sure any quick-release levers on the wheels can be closed without obstruction and aren't pointing down. Closing the lever should require firm but not excessive force. If it's too easy, open the lever and wind the nut on the opposite end of the skewer clockwise to increase the tension, before reclosing the lever.



4B WHEEL BEARINGS

Stand next to the bike and hold the fork with one hand while moving the front wheel back and forth with the other. There shouldn't be any play or clunking from the wheel. If there is, you may need to replace the bearings or tighten the cones in the hub. Repeat for the rear wheel, holding the frame.

- ✓ Track pump
- ✓ Digital tyre pressure gauge
- ✓ Torque wrench (optional)
- ✓ Spoke key
- ✓ 3mm Allen key
- ✓ 4mm Allen key
- ✓ T25 Torx key
- ✓ Phillips screwdriver

WORKSHOP WISDOM

Tyre pressure really affects how your bike rides. As a rule of thumb on an MTB, run the lowest pressure you can get away with without puncturing or the tyre squirming on the rim. This will give you the most grip and allow the tyre to absorb trail irregularities – it's a myth that higher pressures are faster. Optimum pressure will depend on your weight, riding style, the terrain and tyre choice. Buy a digital gauge for quick and accurate readings. Start with 25psi front and 28psi rear, and work from there. Hit the trails and see how low you can get away with. Stop when you notice your tyres rolling when cornering or if you're puncturing too often.

1B BRAKE PRESSURE

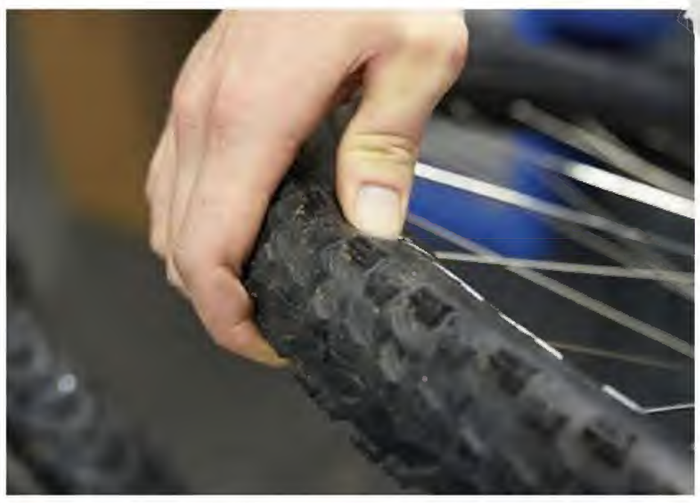
Give the levers a firm squeeze. They should move a little way before stopping with a firm resistance. If not, they may need bleeding (assuming they're hydraulic discs) – talk to your local bike shop if you're not happy doing this yourself.

1C DISC AND PAD RUB

Lift each wheel off the ground in turn and spin to listen for the rotor rubbing on the pads. If the brake is rubbing, loosen the calliper bolts half a turn with a 5mm Allen key, turning them anticlockwise. Spin the wheel again, then squeeze the brake lever while carefully retightening the bolts. Repeat if necessary until there's no rotor rub.

1D STOPPING POWER

Go for a short ride somewhere traffic free and flat. While moving, squeeze the rear brake with one finger – it should be powerful enough to lock up the rear wheel on tarmac. Repeat for the front brake – it should be able to slow you down rapidly without needing to squeeze too hard.



2C THUMB TEST

If you don't have any sort of gauge you'll have to make do with the good old 'squidge' test. Grip the tyre in your hand and push your thumb as hard as you can into the sidewall. You should be able to move it about 1cm inwards (far less on a road tyre), but no more. Adjust the pressure using a pump if necessary, then retry.

CHECK THE SHIFTING

3A REAR MECH POSITION

First check the rear mech is securely attached to the hanger – use a 5mm Allen key to tighten it. Next, check the mech and its hanger are straight. The cage of the mech should hang perfectly vertically. If the hanger is bent, ask your local bike shop if it's repairable – they can order you a new one if it isn't.

3B GEAR RANGE

With the bike in a workstand, spin the cranks while pushing the rear mech towards the wheel. If the chain falls off the top of the cassette, turn the 'L' screw on the mech half a turn clockwise. If the mech won't move far enough over to shift the chain onto the biggest sprocket, turn the screw anticlockwise.

4C SPOKE TENSION

Run your hand over all the spokes on the wheels to make sure they're tight. If just one of the spokes is loose, use the correct sized spoke key to tighten the spoke nipple, turning it clockwise. If several of the spokes are loose, ask at your local bike shop whether your wheel can be trued.

4D BAR POSITION AND BOLTS

Check that the handlebar is straight – it should line up with the dials at the top of the fork legs. Next, check all the bolts on the stem are tight, using the appropriate Allen keys. If the bolts need tightening, use a torque wrench to cinch them up to the manufacturer's recommended settings, turning them clockwise.

4E HEADSET PLAY

Check for play in the headset. Pull the front brake while rocking the frame back and forth and feeling for movement between the head tube and fork steerer. If there is play, loosen the stem clamp bolts (anticlockwise), tighten the steerer bolt in the top of the headset, straighten the bar then retighten the stem bolts.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

20 mins

SMOOTH SHIFTING

Imprecise shifting and a chain that wanders up and down the cassette of its own accord can really spoil your ride. The good news is that the solution takes seconds

When your gears are mis-shifting then it's almost certainly time to take a look at your gear indexing – the relationship between one click of the shifting lever and the distance moved by the front or rear mech. A correctly adjusted set-up will mean your chain can pass smoothly from one cog to another. Not knowing what bike you have, here are the three most common adjustments associated with gear systems from Campagnolo, Shimano and SRAM.

One common mistake when it comes to adjusting indexing is taking a screwdriver to the two limit-screws in an attempt to rectify a noisy or mis-shifting chain. These screws are present only to limit the mechs from shifting the chain too far. They should only be adjusted when you've replaced a worn cassette or rear mech or you've fitted new cranks, for example.

The first thing to do is to make sure your cables, mechs and chain are in good, serviceable condition because this can adversely affect the way they operate; it's no use trying to adjust something that is worn beyond adjustability. If you're having trouble shifting up and down, chances are you'll need to clean your gear cables or fit new ones. A new chain, and possibly a new cassette and/or chainrings might well be on the cards too. Also ensure that there's no play in your bottom bracket bearings because wear here will skew the adjustments you're about to make to your gears. If you have an old tapered bottom bracket on your bike, now is the time to make sure the crank arms are tight on the axle. If you have this type of crank and bottom bracket, tighten the crank end bolts to 26Nm with a torque wrench. If you don't have a torque wrench make sure the bolts are tight using the appropriate Allen key or 14mm hexagonal socket. If the cable adjuster on the rear gear mech is already screwed halfway out, then make adjustments only to the frame-mounted adjuster or one that's in-line with the cables.

2 SRAM DOUBLE TAP

2A SLOW TO LARGER COG

SRAM can shift up to three cogs at a time, but uses a single lever to perform both up and down shifts. If the chain is slow to shift to a larger cog, unscrew the aluminium adjuster on the back of the mech (anticlockwise) a quarter of a turn until the chain shifts smoothly. Due to the leverage ratio SRAM uses on its shifters, start with quarter turns on the cable adjuster before fine-tuning with eighth turns.

2B SLOW TO SMALLER COG

Press the right hand lever up to, but not beyond, the first click and observe whether the shift to the next smallest cog is smooth and silent. If it isn't, you need to screw the rear mech cable adjuster inwards (clockwise) until the chain shifts smoothly and quickly. Here you are reducing cable length to allow the mech to stay more towards the smaller cog and respond faster per click.

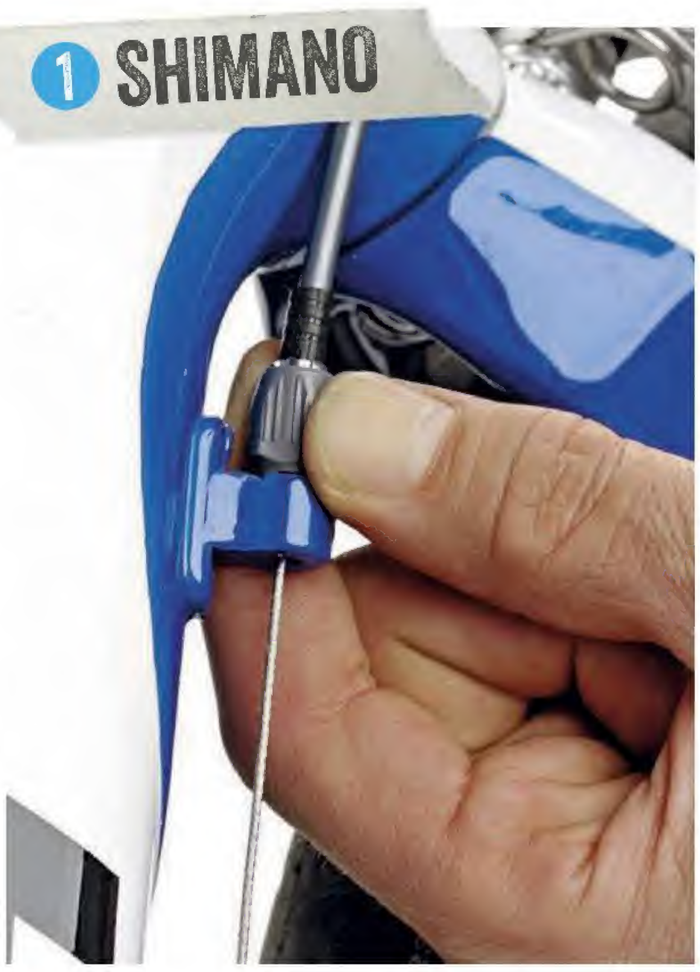
2C FRONT GEAR SOLUTION

The left hand lever operating the front mech works in much the same way as the right one, but you might experience a slow shift from the small to the larger chainring. If so, unscrew the in-line or down-tube-mounted cable adjuster (turn it anticlockwise) an eighth of a turn at a time until it shifts smoothly at the end of the full extent of the lever movement.

✓ 5mm Allen key and pliers. If the adjuster is at the limit you might need a 5mm Allen key to loosen the inner cable clamp and draw the cable tight using a pair of pliers. Otherwise, this is a job for your fingers only.

✓ 14mm hex socket and bar, or appropriate size Allen key for the crank bolts.

1 SHIMANO



1A LOW TO LARGER COG

If the shift is slow or the chain doesn't shift at all, go to the adjuster mounted at the top of the down-tube or, if you prefer, the cable adjuster on the rear mech. Unscrew it (anticlockwise when working from the top) an eighth of a turn at a time until you are satisfied that the chain shifts quietly and smoothly. This will add cable length, making the mech more responsive to each click.

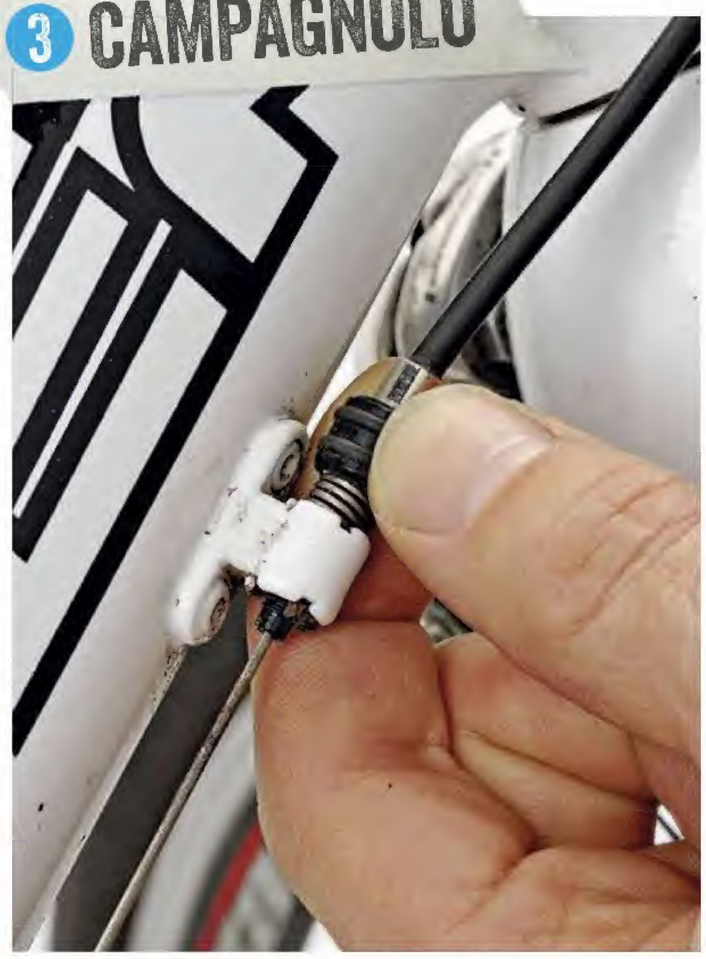
1B SLOW TO SMALLER COG

As you might expect, this is the opposite of slow shifts to larger cogs so this time you will need to screw in the adjuster – turning it clockwise – an eighth of a turn at a time (most Shimano adjusters have indents marking an eighth that you can feel as you turn) until you're happy with the improvement. This will remove a little cable length, so the mech will move further towards the next smaller sprocket to allow the chain to shift cleanly onto it.

1C FRONT GEAR SOLUTION

With the chain on the small chainring, press the left hand STI lever inwards to the full extent of its travel and observe whether the shift from the small to the large chainring is at all hesitant. If it is, unscrew the cable adjuster (anticlockwise) until the front mech carries the chain smoothly and quietly to the larger chainring. This adds length to the cable, making the mech move further towards the large chainring, pushing the chain onto it quickly and smoothly.

3 CAMPAGNOLO



3A SLOW TO LARGER COG

If the chain is slow to shift, use the adjuster at the top of the down-tube or on the rear mech and unscrew it (anticlockwise) an eighth of a turn at a time to increase cable length. Campag rear mech cable adjusters don't have indents when you turn them so you can get finer adjustments, and they use a simple spring to stop them vibrating loose.

3B SLOW TO SMALL COG

If your chain is slow to shift to a smaller cog, or you've adjusted the rear mech to improve shifting to the next largest cog and subsequently found this has made the shift to a smaller cog slower than it was before, screw the adjuster inwards (turn it clockwise) a little at a time until the shifting is crisp and smooth again. If it will only set up well in one direction, then it's time for new cables.

3C FRONT GEAR SOLUTION

If the chain is slow to shift to the large chainring, or to the next largest on a triple chainset, unscrew (turn anticlockwise) the cable adjuster at the top of the down-tube until the chain shifts smoothly towards the end of the shift lever travel. As with slow shifts to larger cogs on the cassette, this adds cable length, making the mech move a little faster per shifter click.

ROAD
OFF-ROAD

BEGINNER **EXPERIENCED** EXPERT

15-30 mins

£10 upwards for a new chain if needed

SETTING UP A TRANSMISSION

A silent, smooth-running transmission can make all the difference to your ride. Follow our 16-step guide carefully and you'll get it right every time

1 FIND STOP SCREWS

With the front mech in place and the chain removed, the first step is to locate the stop screws. These control the range of motion, and are marked H (high) and L (low). They're adjusted with a Phillips screwdriver. On a top-swing front mech, the L screw is the inner screw – it controls the limit of the mech's inward motion. The high screw is the outermost screw and it limits the mech's outward motion. On a bottom-swing mech, this is reversed.

5 FIT GEAR CABLES

Apply a light lube to the gear cable outers to help ensure the free running of the gear cable. Then, thread a new, clean gear cable through the bar-mounted shifters and through the gear outers for both the front and the rear mech.

6 SET FRONT CABLE

With the front shifter set on the lowest gear position (normally marked '1'), run the gear cable through the anchor bolt of the front mech. Pull it taut using a pair of pliers at the same time as you tighten the anchor bolt. Push the gear shifter a few times to seat the cable properly, then loosen the anchor bolt and take up the slack before re-tightening the bolt.

7 SET REAR CABLE

With a normal rear mech, set its shifter on the lowest gear position (usually marked '1'). For a Low Normal/RapidRise mech that springs to the smallest sprocket, set it to the highest gear position (usually marked '8' or '9'). Thread the cable through the anchor bolt and hold the cable tight with pliers before securely fastening it. Push the shifter a few times to seat the cable. Then loosen the bolt, take up the slack and re-tighten.

11 CHECK THE CHAIN

With the chain in place, check the front and rear mech stops. The front mech plates should clear the chain by 2mm. If there's any rubbing, fine-tune the H/L screws accordingly to move the mech plates, but make sure that the chain cannot get dumped off either the small or large chainring during a rapid or dynamic shift. The rear mech jockey wheels should also be directly beneath the largest and smallest sprockets at their H and L limits.

12 GEAR INDEXING

Once the stop screws and B-angle screws are correctly adjusted, the rear mech's indexing can be sorted. This is done by changing the tension of the gear cable at the barrel adjuster, which is on both the shifter and rear mech for Shimano, and at the shifter only for SRAM. Shift the chain to the largest chainring and shift the rear mech by one click only. If the shift occurs smoothly, cable tension is adequate. If it doesn't, it's too slack.

13 REMOVE SLACK

Turn the barrel adjuster all the way in – at the rear mech or shifter – and then anti-clockwise by two turns to allow for adjustments. Loosen the inner wire pinch bolt and gently pull through any cable slack using a third hand tool or a pair of pliers. After that, tighten the pinch bolt.

- ✓ Phillips screwdriver
- ✓ Pliers or third hand tool
- ✓ 3mm and 5mm Allen keys
- ✓ Chain tool and lube

WORKSHOP WISDOM

It's possible to set up your mechs with the chain in place. If you want to do this, you can either split it or undo the mech's cage split clamp using a screwdriver and slip the chain out. Rest it on the bottom bracket shell. At the rear, remove the jockey wheels using a 3mm Allen key. Then slip the chain out of the cage before replacing the jockey wheels and reassembling the mech cage.
If you're still having problems after setting up your drivetrain, or if the chain is rubbing excessively on the front mech, the mech cage might be damaged, or it may not be parallel with the chainrings. To adjust the mech cage, undo the mech clamp on the seat-tube and tweak it so that the cages line up. Then retighten the clamp and attach the gear cable. Problems with bad rear shifts might be caused by a bent gear hanger, so check for this and replace as necessary.

2 SET FRONT SCREWS

Set the L screw so that the front mech cage's inner plate is roughly 4mm from the smallest chainring. Then, pushing the mech cage out by hand, set the H screw so that the outermost plate of the mech cage is 4mm from the outside of the big chainring.

3 SET REAR SCREWS

Similarly, roughly set the rear mech's H and L screws. Turning the screws anti-clockwise allows the mech to move towards the spokes, and clockwise moves it away from the spokes. The top jockey wheel of the mech should stop directly under the largest cassette sprocket (adjust the L screw to do this) and directly below the smallest cassette sprocket (adjust the H screw).

4 B-ANGLE SCREW

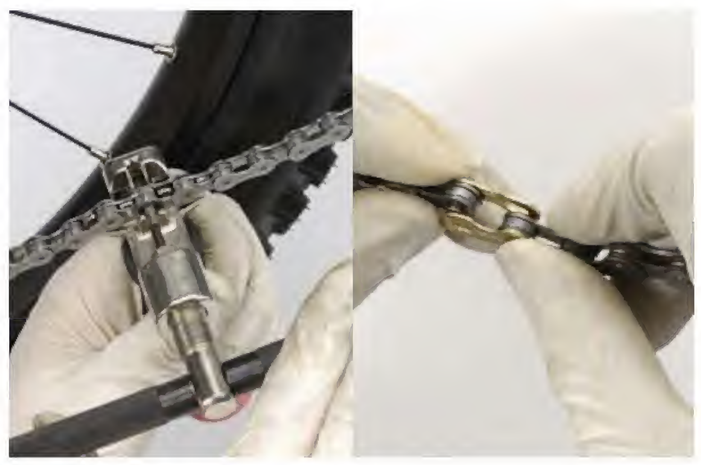
Most rear mechs have a third screw — called either the B-tension or B-angle screw — which adjusts the clearance between the top jockey wheel and cassette sprockets. Using a Phillips screwdriver, adjust it so that the distance is 5-6mm. This ensures that when you put the chain on, it will be close enough for quick shifting, yet clear enough that the chain can pass freely without clicking from the second largest sprocket to the largest.

8 CHAIN LENGTH

To get the correct chain length, bypass the rear mech and thread the new chain around the big ring and the biggest rear sprocket. Bring the chain ends taut and together, and add three whole chain links. Remove any excess length of chain using a chain tool. This should give you the correct chain length for your gearing.

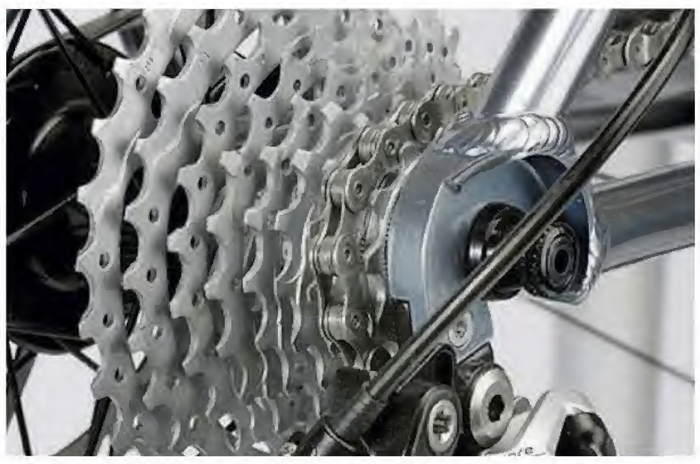
9 THREAD THE CHAIN

Thread the new chain through the front mech cage, over the cassette sprockets, over the top jockey wheel, through the rear derailleur cage and around the lower jockey wheel correctly. Drop it off the big ring to rest on the bottom bracket shell and onto the smallest cassette sprocket. This will give you enough free links to easily connect the chain together.



10 JOIN THE CHAIN

For Shimano, bring the links together and insert a Shimano joining pin. Press the pin into place with a chain tool and snap off the protruding guide pin with pliers. For SRAM and KMC chains, use the PowerLink to connect the chain by slotting each half of the link through each end of the chain, and then bringing them together to snap the two pin halves of the link together. Finally, pull the halves to securely seat the link.



14 TENSION S.O.S.

If the mech won't shift one sprocket after removing the slack, change the shifter to the highest gear (smallest cog) position. Increase the cable tension by turning the barrel adjuster on the mech or shifter anti-clockwise by a quarter of a turn. Shift to the second smallest sprocket. Turn the pedals and increase cable tension by turning the barrel adjuster anti-clockwise until you hear rattling – this is the chain scraping against the next sprocket.

15 REMOVING THE RATTLE

Once this rattle occurs, turn the barrel adjuster clockwise by a quarter-turn to release the cable tension, and then pedal again. Listen and look for signs of chain scraping and/or rattling, and continue to turn the barrel adjuster clockwise by quarter-turns until the rattling disappears.

16 FINAL CHECK

Shift by one sprocket at a time from the smallest cog to the largest, listening and looking for signs of rattling that would indicate a too-tight inner cable tension. Turn the barrel adjuster clockwise by a quarter-turn at a time to eliminate any rattle. Shift the front mech to the smallest chainring and check the gears again. If there's no rattling or chain rubbing, the gears are properly indexed. Simply lube the chain and you're ready to ride.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

30 mins

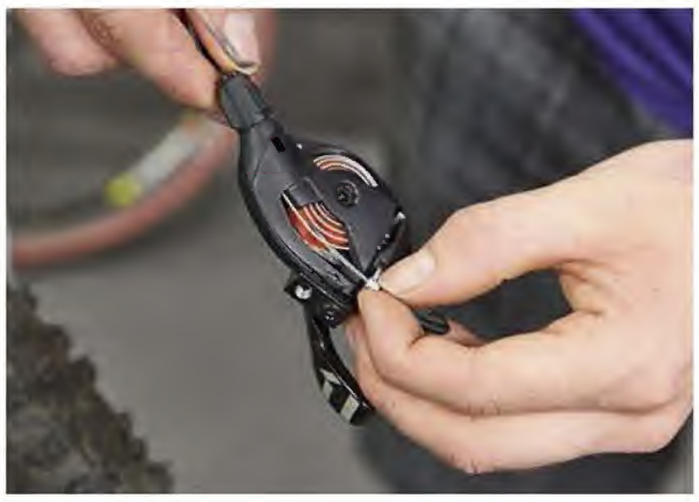
Approx £25 for full set of new cables, end caps and ferrules

FIT NEW CABLES AND INDEX YOUR GEARS

If your shifting's stiff or unreliable, follow this guide to get your gears running smoothly again

1 SET THINGS UP

Make sure your bike is clean, then clamp it in a workstand. Check that the rear mech and its hanger are straight, and that the bolt holding the mech onto the hanger is tight. While turning the cranks, shift into the smallest cassette sprocket and smallest chainring. Use a 5mm Allen key to loosen the cable clamp bolts on both mechs a few turns, turning it anticlockwise.



3C OLDER SRAM SHIFTERS

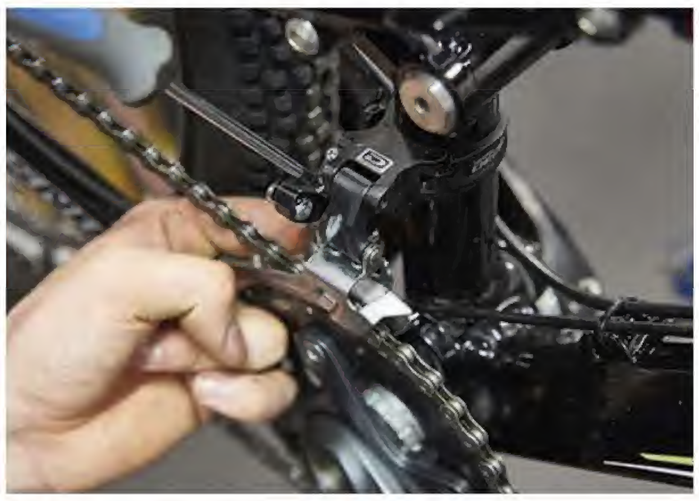
Some older SRAM shifters have a winged screw or Allen bolt cap on top. Use your fingers/a 3mm Allen key to remove this, turning it anticlockwise. Carefully push the exposed section of inner cable into the shifter. When the end pops out from under the spring, pull the cable out – taking care not to dislodge the spring – and discard it. Repeat on the other shifter.

4 CHANGING CABLE OUTERS

It may be necessary to replace the outer cables too. In this case, remove all the old outer cables from the bike. Either cut new sections to match their length or cut a single section of outer cable to the same length as the exposed part of the old inner cable to create a full-length outer cable run. Use a pick to open up the ends. Install the new outer cables on the bike.

5 LUBE THE NEW INNER

Lightly coat the new inner cables with lubricant by running them through a cloth or sheet of workshop paper impregnated with cable lube or 'wet' chain lube. Carefully feed the cables into the shifters in a reversal of step 3.

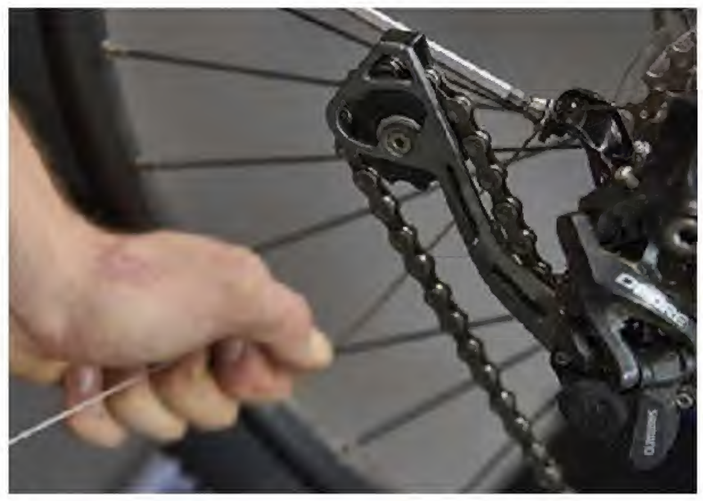


9 ADJUST THE FRONT MECH 1

Turn the cranks while pulling the front mech away from the frame. The chain should shift onto the largest chainring easily. If not, turn the screw marked 'H' anti-clockwise half a turn at a time until it does. If the chain is pushed off the chainring, wind the screw clockwise until this no longer happens. Fine tune until the largest chainring is right in the middle of the mech.

10 ADJUST THE FRONT MECH 2

Continue turning the cranks but release the front mech. The chain should drop onto the smallest chainring and stay there. If the chain falls off the chainring towards the frame, turn the 'L' screw clockwise. If the chain is reluctant to shift onto the smallest chainring, turn the 'L' screw anticlockwise. Adjust until the mech sits centrally over the smallest chainring.



11 TENSION REAR CABLE

Route the inner cable through the groove under the clamp bolt on the rear mech. Without moving the mech, pull the cable to apply a little tension. Tighten the clamp bolt until snug, turning it clockwise with a 5mm Allen key. Let go of the cable. Click through the gears while turning the cranks to tension the cable. Loosen the clamp bolt, take up any slack and retighten.

- ✓ T25 Torx key
- ✓ 3mm Allen key
- ✓ 4mm Allen key
- ✓ 5mm Allen key
- ✓ Cable or wet lubricant
- ✓ Phillips (crosshead) screwdriver
- ✓ Pick (or old spoke)
- ✓ Cable cutters
- ✓ Workshop paper or cloth

WORKSHOP WISDOM

Before you start replacing cables and indexing gears, remember that there are other things that can cause sloppy shifting. First, check that the rear mech is bolted to its hanger tightly, that the hanger is bolted to the frame securely and that the rear wheel is properly installed. Next, check that the mech hanger and rear mech are straight and that the mech cage is in line with the chain. If the hanger is bent, ask your local bike shop to straighten it – or order in a new one if it's too far gone. Finally, check that the front mech cage is parallel to the chainrings and the right height above them. It should just clear the teeth of the largest ring.

2 EXPOSE INNER CABLES

Wind the barrel adjusters on the shifters fully clockwise, then back them off two turns to allow adjustment later. Cut the cable end caps off the old gear cables using a good quality set of cable cutters. Grip the outer gear cable next to the first shifter with your fingers and pull it out a few inches, exposing the inner cable. Repeat on the other shifter.

3A SHIMANO SHIFTERS

If you have Shimano shifters, use a Phillips screwdriver to unscrew the plastic plug on the opposite side of the shifter to the barrel adjuster, turning it anticlockwise. Put the plug somewhere safe. Push the exposed section of inner cable into the shifter. When the end pokes out the other side, pull the cable out and discard it. Repeat on the other shifter.

3B NEWER SRAM SHIFTERS

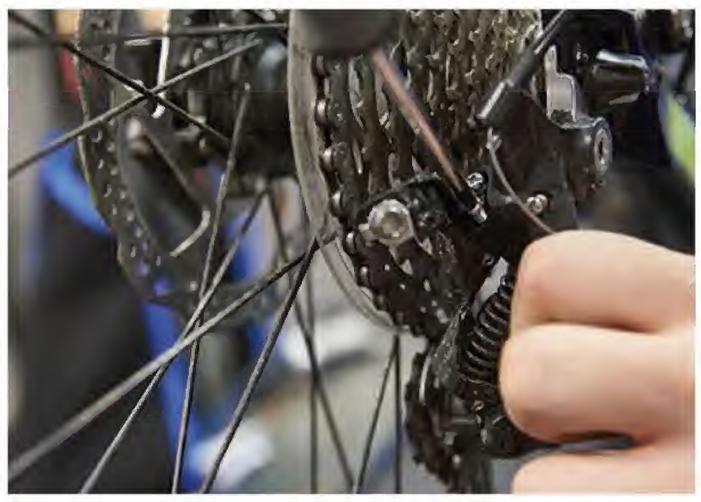
If you have SRAM shifters with a rubber tab on top, use a 4mm Allen key or T25 Torx key to remove the shifter from the bar, turning the bolt anticlockwise. Peel the rubber tab upwards with your fingers. Push the exposed section of inner cable into the shifter. When the end pokes out from under the rubber tab, pull the cable out and discard it. Repeat on the other shifter.

6 FIT THE NEW INNER CABLE

Feed the inner cable through the narrow end of a new ferrule, then the outer cable, then the wide end of another ferrule. Push the ferrules onto the outer cable. Repeat on each section of outer cable. Pull the inner cable through until the cable head is seated inside the shifter. Refit the plug/tab/screw/cap. Refit the shifter on the bar, if removed. Repeat on the other shifter.

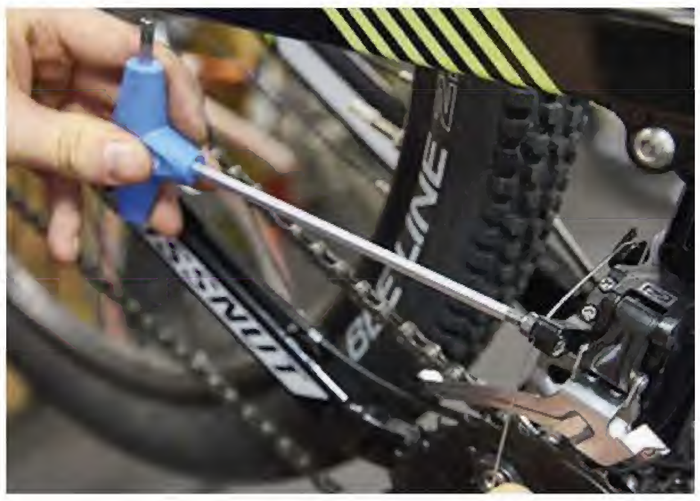
7 ADJUST THE REAR MECH 1

Turn the cranks. The chain should sit on the smallest cassette sprocket. If not, use a Phillips screwdriver to adjust the screw marked 'H'. Turn it anticlockwise to move the rear mech closer to the frame or clockwise to move it closer to the wheel. Adjust until the rear mech's top jockey wheel sits directly below the smallest sprocket.



8 ADJUST THE REAR MECH 2

Turn the cranks while pushing the rear mech towards the wheel. The chain should sit on the largest sprocket, with the top jockey wheel directly below it. If not, adjust the screw marked 'L'. Turn it clockwise if the chain is too close to the spokes or falls off the top of the cassette. Turn it anticlockwise if the chain won't move up from the smaller sprockets.



12 TENSION FRONT CABLE

Ensure the front mech cage is in line with the smallest chainring and the cable is correctly routed to the clamp bolt. Tension the cable and tighten the clamp bolt, turning it clockwise with a 5mm Allen key. Let go of the cable. Click through the gears while turning the cranks. With the chain back on the smallest ring, loosen the clamp bolt, take up any slack and retighten.

13 INDEX THE GEARS 1

Turn the cranks and click through the front gears. If the chain is reluctant to shift onto the bigger rings, turn the barrel adjuster on the shifter anticlockwise. If it's reluctant to shift onto the smaller rings, turn the adjuster clockwise. When the shifting is smooth, use your cable cutters to cut the inner cable a few centimetres from the mech and crimp an end cap in place.

14 INDEX THE GEARS 2

Turn the cranks and click through the rear gears. If the chain is reluctant to shift onto the bigger sprockets, turn the barrel adjuster on the shifter anticlockwise. If it's reluctant to shift onto the smaller sprockets, turn the adjuster clockwise. When the shifting is smooth, cut the inner cable a few centimetres from the mech and crimp an end cap in place.

ROAD
OFF-ROAD

BEGINNER **EXPERIENCED** EXPERT

30 mins

£30 for the sealed cable kit

FITTING SEALED CABLES

Fed up with gritty, sluggish cables? Then why not keep them moving smoothly by fitting a sealed system? We show you how...

Fed up with stripping, cleaning and lubing your cables after every mucky winter ride? While the up-to-date practice of having slotted cable guides on a frame undoubtedly makes life easier for quick, tool-free cleaning, it gets tedious after a while, and the inner coating of the cable housing eventually gets too rough and gritty to work effectively. Sealed systems, such as Jagwire cables, have an outer, an uninterrupted PTFE middle liner, through which a PTFE-coated cable slips with no chance of contamination. Available for road bike brake and gear systems and MTB gears, the Elite Sealed versions are the ones to get. They are a little pricey at around £30, but are well worth it and are very durable when correctly installed.

1 REMOVE CABLES

Cut cables and caps, then loosen anchor bolts and release the cables. It might be advisable to cut the cables between the outers and anchor bolts, to help pull them through without getting caught. Beware of frayed cable strands (as pictured) stabbing your fingertips. Make a note of the routing and which cables go through which cable guide stops. Give everything a clean with a shot of WD40 or similar, especially hard-to-reach places adjacent to the frame guides where dirt has a way of accumulating. Remove the barrel adjusters by turning them anti-clockwise, making sure you catch the small tension spring. Clean the threads and grease or oil them to ensure they turn freely with full travel and don't seize up in the future.

5 THREAD THROUGH LINERS AND CAP OFF

Remove the new cables from the liner by cutting the anchor end that you won't be using. For brakes, road ends are pear shaped and MTB ones are barrel shaped; keep the one you'll need. For the derailleur cables, the smaller ends are for Campagnolo (4mm), and the larger ones for Shimano and SRAM (4.4mm). Thread the liner through the outer by inserting it into the end closest to the shifter or brake lever. Gently pull it all the way until the trumpet-shaped tip is seated, then cap with a ferrule, as pictured. Thread through and seat a ferrule on the other end, then position completed outers into the frame guides, while threading the liner in a continuous path along the frame.

6 TRIM LINER TO LENGTH

Trim the liner to length, allowing the correct amount to be exposed – don't nick or kink it while cutting and manipulating. A specific amount of liner needs to protrude between the barrel adjuster end and the anchor bolt, depending on its location. First ensure that all the outers and ferrules are in place. Pull the liner all the way through, making sure that it's properly seated. Before threading through the cables, trim the liners at the following distances: on the front derailleur (in small ring) about 25mm from the anchor bolt; on rear mechs, in the small cog, trim the liner at 10mm from the cable exit, before the anchor bolt; for brakes, trim at about 10mm from the exit of the last length of outer, checking that brake travel doesn't interfere.

7 INSTALLING GRUB SEALS

Carefully thread the cable through, making sure you don't damage the coating on any sharp edges. The next step is an important one as the little bellows device, which Gore calls a Grub Seal, prevents grit from entering through the one small vulnerable area in the system, and is the final line of defence against unwanted contamination of the system. Each time a shift or braking action is engaged, a small amount of cable gets pulled out or re-enters the liner, offering an entry point for grit to work its way in, as happens in a standard cable system. So finish by installing a Grub Seal pointy end first, as pictured, over the end of the cable. Cover about 10mm of the exposed liner, and with the remainder cover the cable.

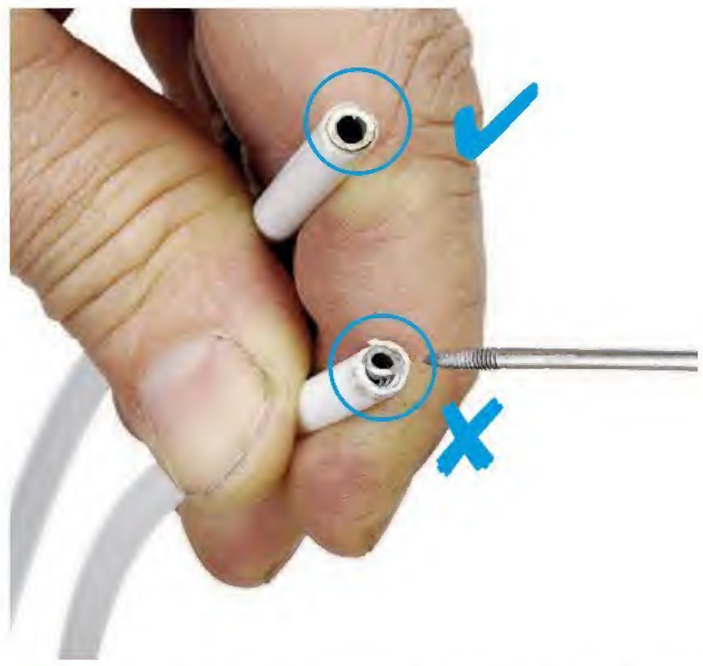
- ✓ Allen keys, scribe/awl
- ✓ Small screwdriver
- ✓ Files/small round file
- ✓ Pliers, wire cutters
- ✓ Sealed cable kit

2 PREP FRAME - OPEN GUIDES

You might find that the liner doesn't quite fit through the slot, so a bit of filing or drilling might be required, especially on older frames with smaller cable guide apertures. Where a drill might be difficult to use because of a lack of space, carefully position a round file as pictured. Open the cable slot just enough to allow easy passage of the liner without nicking or damaging it. If a drill can be positioned safely, use a 2mm bit. If you need to drill the barrel adjusters make sure they're safely held in a vice before putting the drill through, to avoid sudden snagging by the bit. Take the opportunity to install some frame protection patches at any points where cables might rub.

3 CUT OUTERS TO CORRECT LENGTH

Sizing cable outers correctly is a crucial step in the installation process. An outer that's too short can bind when the handlebar is turned, causing unwanted braking or ghost shifting at the worst possible moment. If your original outers were correctly sized you can use them as a guide, but more often than not, stock outers are too long and could be helped by better routing. Choose the cable stops that give your outer the most gradual curve, with no sharp bends. If re-cabling under handlebar tape, fasten the outer firmly against the bar to prevent power-sapping movement. Problem areas like the cable stop headset spacer can sometimes be solved by looping the outer over the stem.



4 SQUARE OFF CABLE OUTER ENDS

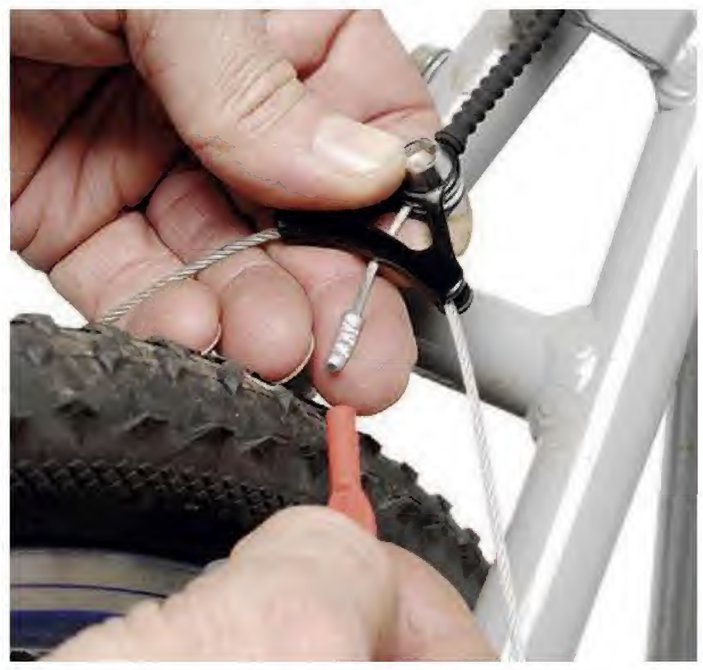
The outers need to be squarely and fully seated into their respective cable stops and guides, without causing any cable interference. Note the right and the wrong way, as pictured. After cutting with a good set of wire cutters, squeeze the ends back into a circular shape if they've been ovalised. Now holding an end firmly, dress it with a few strokes of a sharp file to square it off flat. Finish by inserting the point of an awl or sharpened spoke to smooth out any burrs, which could dig into the liner. Be careful not to slip and stab yourself! Repeat for all the ends of all cable-outer sections. If you have a bench grinder in your workshop, you could use it to speed things up.

8 ADJUST GEARS

Now that you've got the cables correctly in place, you can set about adjusting the gears; but first bed in the new cables, outers and ferrules by stressing the system. You can do this by gently pulling a section of exposed cable by hand while turning the pedals until the derailleur shifts through the gears to its travel limits. Or, for the rear mech, simply activate by pushing the parallelogram by hand. Go easy as you approach the spokes on the rear wheel. If the low limit screw isn't correctly adjusted, the rear mech could tangle with the spokes, so ensure it's in contact and preventing further movement. The same rule applies for the front derailleur. Use barrel adjusters to fine-tune the shifter stroke, so that one click grabs exactly one gear.

9 ADJUST BRAKES

While adjusting a modern dual pivot side-pull brake is fairly straightforward, stringing up a set of 'heritage'-style cantilevers that use an old-fashioned straddle wire (as opposed to a preset Shimano-style link wire) can be more tricky. Use either a third hand tool or an old toe strap to hold the brakes against the rim, freeing up a hand to thread cable through the yoke and cable anchor. Better still is a fourth hand tool, pictured, which helps draw the cable through the anchor bolt, setting the brake position in the process. Immobilise the back of the anchor with a 10mm socket spanner and tighten firmly at the front with a suitable Allen key (usually 5mm). Ensure brake blocks contact the rim with no tyre rub.



10 TEST AND RE-ADJUST

Now you need to get on your bike, hammer through the gears and slam on the brakes half a dozen times or so to make sure everything's bedded down. Pay particular attention to the shift from the large to small ring while in the second-largest cog, and the other way around, from the small ring to the big while in the second-smallest outside cog; these are the gears most likely to cause the chain to overshift and come off. Re-adjust the brake cables at anchor bolts if required, or simply use the barrel adjusters to tighten things up a bit. Now finish off by carefully crimping the metal end caps over the cable ends to prevent fraying, and for a touch of colour, install the red rubber ID crimps.

ROAD

OFF-ROAD

BEGINNER EXPERIENCED EXPERT

30 mins

£3 - £30 cable kit
£10 - £30 bar tape

FITTING SHIMANO GEAR CABLES

We'll come to Campagnolo and SRAM shifting kits later, but for now it's the turn of Shimano, whose Dura-Ace, Ultegra and 105 units incorporate internal cable routing

When Shimano's STI units appeared on the scene, the brand originally had exposed gear cables. But the company relented and eventually decided to run hidden gear cables along the inside of the bars. When you're installing these you'll find some similarities with other units. However, some aspects, such as a hidden reach adjuster, will be unfamiliar, so let's take a look at how to set the kit up properly. Remember, if you're ever in doubt about your handiwork, take your bike to a professional at your local bike shop and ask their opinion.

If you're running Campagnolo shifters see page 24. And for SRAM turn to page 26.

1 INSTALL LEVERS

Ensure your bars are positioned correctly, with the lower flats pointing at an angle somewhere between 0 and 30 degrees below the horizontal. The transition of the drops from the flats will determine whether your bars stay level or you need to angle them downwards in order to achieve a comfortably flat hood zone transition. Using a 5mm Allen key, open up the clamp to its maximum by unscrewing the clamp bolt, then slide the lever onto the bar to the desired position. Although the lever body shape has been changed to minimise the risk of damage, you still need to ensure the lever is located on a section of the bar with a matching radius – in other words, neither too high nor too low on the bar.

5 KINKY BUSINESS

Any type of sharp curve or bend put into the cable will be felt through the shifting system, and can cause delayed shifting response and inaccurate gear selection, so Shimano has included a groove which solves this. Notice the protruding cable end – the derailleur cable insert hole is located underneath the lever body, about midway. Before threading, return the cable carrier barrel to its starting position by tapping the release paddle several times; this will line up the cable anchor seat with the opening in the lever body. A small cover on each lever can be removed, as pictured, to improve access to cables and the shifter mechanism, or aid in threading the cable through. Outside left simply pries off, inside right needs a small screw removed.

6 CORRECT ANCHOR ROUTING

This is crucial in getting the right pull ratio out of the derailleur. If in doubt, remove the anchor washer and have a close look. There'll be a groove on the actuator lever, along with the washer, which will leave you in no doubt which way the cable needs to go. Make sure you've noted the washer's anti-spin tongue and located it correctly. Apply a drop of lube on the barrel adjuster threads and wind it all the way in. String the cable through the last section of outer, having filed the ends square and capped them with ferrules. With the high limit screw set as correctly as possible, use a set of needle nose pliers to pull the cable tight before nipping up the anchor bolt firmly (about 5nm).

7 ADJUST CHAIN LENGTH

Shimano's chain length adjustment technique is a little different to its rivals, but ends up with essentially the same result: a length that will accommodate the large ring and large cog (a combination to be avoided if at all possible), and end up with the derailleur jockey wheels in a more or less vertical position when in the big ring and smallest cog. Check the chain tension in the small ring/small cog combo to make sure it's not simply flapping about. If it's borderline loose, you can tighten things up a bit with the B adjustment screw located by the hanger bolt. Designed to adjust the tracking of the upper jockey wheel, turning it clockwise a bit raises the spring tension and tightens the chain a little.

- ✓ Cable cutters/needle nose pliers
- ✓ Ruler or tape measure
- ✓ Light grease/oil
- ✓ Chain tool and metal file
- ✓ Scribe/small poking tool
- ✓ Allen multi-tool
- ✓ Small Phillips and flat precision screwdrivers

2 CLAMP IT TIGHT

As with SRAM's shifting kit, pay attention to lever offset. Avoid pointing the lever body inwards, which would reduce the amount of offset and increase the possibility of the lever running out of travel and striking the bar. A square ended 5mm Allen key is preferable to a ball-end type, as the latter doesn't always provide secure engagement. Tighten firmly (about 8nm), to the point where the lever body can't be moved sideways; a strong sideways punch should only dislodge it slightly, if at all. Shimano Ultegra 6700 levers offer reach adjustment with the use of a rubber insert, available in 5 or 10mm thickness, placed at the top of the lever. These should be included with your new levers or new bike.

3 FERRULE RULES

Shimano lever bodies will accept a 5.5 outer diameter ferrule capping its 4mm SIS gear cable outer. The 5mm brake outer can run straight into the body with no 6mm ferrule. Cut the outer cleanly with a good pair of pliers, making sure there are no obstructions, such as a crushed Teflon inner lining or a shard of inner wire. Use a scribe or sharpened spoke to pry open the cut end, after dressing it with a few strokes of a file. To offset a potential increase in friction due to the new aero routing, return spring tension has been slightly increased, so it's especially important that cable ends are de-burred and securely squared up and butted into their stops. Allow sufficient cable length to enable free movement of the bars.

4 BRAKE CABLES AND LEVER REACH

Installing the brake cables requires the removal of a decorative cover plate made either out of metal for Dura-Ace, or chromed plastic in the case of Ultegra. Remove the small Phillips screw and gently pry off the plate by angling it away, top first. Use more care for the Ultegra cover – it's a tighter fit and requires more force. Reverse the procedure for installation once you've threaded the cable through. A drop or two of lube will make the cables more slippery and lighten the shifting effort while improving shifting accuracy. Dura-Ace lever reach is adjustable via a small nylon screw adjacent to the brake cable holes.

8 ADJUST STOP SCREWS

Set your high and low gear limit screws by eyeballing the position of the jockey wheels relative to the largest (low) and smallest (high) cogs. The upper jockey wheel should line up directly underneath the respective gear, as pictured. On Shimano units the high screw (marked H) is placed above the low screw (marked L). This tends to be the rule on most of their mechs, both front and rear. Ensure the screw is fully butted, preventing any further travel beyond the desired position. Set your front derailleur so that it just clears the chain in the big ring and small cog, with about a 1 or 2mm gap for the outer edge of the cage, and just barely touches the inside of the cage in the small ring and large cog.

9 TO B OR NOT TO B

As with all rear derailleurs, the accuracy and crispness of shifting response will depend on how closely the upper pulley tracks the cogs. With Shimano, set the B tension screw so that the upper jockey wheel is as close as possible without touching, in the big cog and small ring. (Then check again in the big ring and big cog, for good measure.) Chain length will also influence this adjustment: the shorter the chain length – which will result in more derailleur wind-up – the further away the upper pulley will be from the larger cogs. Removing a link can sometimes help with jockey interference in the largest cog, especially if trying to run a little more than recommended for that mech. Maximum is 27 tooth, 28 in a pinch.

10 TRIM, TAPE AND TEST

Dura-Ace has just one trim adjustment, for the small ring. Actuate the first small click on the large lever, then set the outer edge of the cage so it just barely touches the chain when in the small ring and the smallest cog. On Ultegra, small ring trim is the same as with Dura-Ace, but an additional big ring trim adjustment can be accessed by feathering the small paddle; the inner edge of the cage should barely contact the chain in the big ring and the big cog. Finally, make sure the taping doesn't interfere with the cable access holes, or mechanical functions of the levers. The cable outers need to be firmly taped against the curve of the bars; a cloth reinforced tape can help stop flex and improve brake response. Ride and re-adjust as necessary.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

60 mins

£5 for degreaser

SHIMANO TROUBLESHOOTING

We show you how to fix typical problems with Shimano gear systems. Campagnolo and SRAM systems are similar but both have a few peculiarities of their own

1 CLEANING AND LUBRICATING

Before working on your gears, clean both derailleurs in situ with a degreaser. An old electric toothbrush is useful for getting at all the difficult spots. Lube the main parallelogram pivots with PTFE or Triflon based lubricant. Clean the chain with an in situ chain-cleaning tool. Use a top quality chain lube and lube the rollers of the chain. Don't apply lube to the outside of the chain. If using a spray lube, put a newspaper behind the chain to prevent lube getting on your wheels. Wipe off any excess or it will retain grit.

2 PROBLEMS USING THE BIG CHAINRING

Check that the derailleur cage clears the top of the large chainring's teeth by about 1mm. If necessary, slacken the derailleur mounting bolt by about two turns and move the derailleur up or down to correct its height. Set the derailleur's cage so that a centre line through the cage runs parallel to the chainrings. Tighten the derailleur mounting bolt and check that the derailleur cage does not touch the outer chainwheel. Slacken off any down-tube or cable adjusters by turning them fully clockwise. The outer limit screw is normally the high gear stop (large chainwheel). Shift onto the smallest chainwheel. Slacken the gear cable fastening bolt, pull the gear cable taut and refasten the cable fastening bolt. Shift onto the smallest sprocket and large chainwheel. Adjust the high limit screw so that the outer plate of the cage is about 1mm from the chain. Shift into the smallest rear cog. Repeatedly shift onto the biggest chainring, adjusting the high limit screw half a turn at a time until it does so without hesitation, but does not overshoot the largest ring.

6 PROBLEMS USING THE BIG SPROCKET

Shift into the largest rear sprocket. Check that the upper derailleur cage is in line beneath the largest rear sprocket. If not, adjust the limit screw until the pulley is exactly in line with the sprocket. Now shift to a higher gear and back again to check the chain doesn't overshift the largest sprocket. Screw in low gear adjuster on rear mech (lower screw) an eighth of a turn at a time to stop this.

7 REAR MECH NOT SHIFTING ACCURATELY

The first thing to do is make sure your chain is clean and lubed, as this can spoil shift quality. Otherwise, it's likely that your cable tension needs adjusting. Here's how to sort that out. First, select the top gear, then turn the pedals forward and select the next gear. If the chain doesn't move smoothly to the next sprocket, turn the adjuster anti-clockwise half a turn at a time until it does. Select the next largest sprocket and check that the chain will move cleanly to it. If it won't, turn the cable adjuster anti-clockwise a further quarter of a turn at a time until the change is clean. Check that the upward shifts (to smaller sprockets) are still okay. If not, back off (turning clockwise) the cable adjuster until the shifts are correct.

For 10 and 11-speed, select the second smallest sprocket. Press the STI lever just enough to take up the slack and turn the cranks. If the chain shifts to the third smallest sprocket, turn the adjuster clockwise until the chain returns to the second sprocket. If no noise is heard at all, turn the adjuster anti-clockwise until the chain hits the third sprocket and makes a noise. Return the lever to second gear position; if the chain continues to rub on the third sprocket turn the adjuster clockwise until the noise stops. Check the rear derailleur now works correctly across the full range of the cassette. Bad rear mech hanger alignment is also a common cause of gear indexing troubles. A special tool is required, so this is only for experienced readers. To correct the alignment, screw the special tool to the derailleur threads in the hanger. Adjust the pointer so it is in line with the rim and about 2mm above the rim. Rotate the pointer of the tool to the 12, three, six and nine o'clock positions of the rim. The pointer should be at the same height above the rim at all positions. To correct any misalignment, use the tool to bend the hanger so it is perfectly aligned at all four points. If you do not have the tool or have an aluminium or carbon fibre frame, you should take your bike to an experienced bike shop for a hanger alignment check.

- ✓ 4, 5, 6mm Allen keys
- ✓ Phillips screwdriver
- ✓ Chain checker, chain whip
- ✓ Adjustable spanner
- ✓ Toothbrush, degreaser

3 PROBLEMS USING THE SMALL CHAINRING

Check the derailleur position as in step 1. Slacken off any down-tube or cable adjusters by turning them fully clockwise. Shift onto the smallest chainwheel and large rear sprocket. The inner limit screw is the low gear stop. Adjust this screw so the inner plate of the cage is about 1mm from the chain. Check that under repeated shifting from the largest to the smallest chainring the chain shifts without hesitation, but does not overshoot the small chainwheel inwards. If necessary, adjust the low gear limit screw half a turn at a time either to make the shifting cleaner (anti-clockwise) or to prevent overshifting (clockwise). Be aware though, that many front derailleurs won't shift onto the small chainwheel under a heavy pedalling load, even when correctly adjusted.

4 CHAIN RUBS ON FRONT MECH IN MIDDLE RING

Move the chain onto the middle chainwheel (by moving one click upwards from the small chainwheel) and largest rear sprocket. Adjust the cable tension with the down-tube adjuster so that the clearance between the derailleur's cage inner plate and the chain is between 0.5 and 1mm. Click the front STI lever one click so the chain moves outboard a little. With the rear derailleur, select the smallest rear sprocket. Check that there is about 1mm of clearance between the chain and inner plate of the derailleur cage. If there is not, simply readjust the cable tension (an eighth or quarter turn) of the down-tube adjuster. Then recheck the clearance when the front derailleur is in the inner trim position, and again with the chain on the largest rear sprocket.

5 PROBLEMS USING THE SMALL REAR SPROCKET

With the chain on the largest rear sprocket and smallest chainwheel, check the upper derailleur pulley is as close as possible to the large sprocket without fouling the sprockets (turn the B screw, which controls the derailleur body angle, out nearly as far it'll go). Check for fouling of the other gears, tightening the B screw if necessary. Move the chain to the smallest rear sprocket and middle chainwheel. Back off the cable adjuster on the down-tube completely. Turn the cable adjuster fully clockwise and back off one complete turn anti-clockwise. Loosen the inner cable clamp. The high gear (small sprocket) limit screw is the upper one. Visually check the upper derailleur cage pulley is in line beneath the smallest rear sprocket. If not, adjust the limit screw. With pliers, pull the inner cable taut and tighten the cable clamp. Adjust indexing as in step 6.

8 CABLES NEED REPLACING

Use the old outer cables as a guide for the new outer cable lengths. The length to the stops on the frame must be enough that the bars can be turned without tugging the cables. Use sharp cable cutters to trim the outer gear cable. The end may become slightly flattened, so squeeze it back into shape. Use a file to get the end as flat as possible and then open the liner up with a sharp point before fitting the ferrule. Select the top gear. Back off all the cable adjusters. Loosen the cable clamp bolt and push the inner cable out through the shifter. Feed the new inner gear cable through the shifter lever and housing and through the first section of outer cable. Continue feeding the inner cables through the stops, bottom bracket guides and outer cable. Check that the ferrules are fitted and properly seated in the stops. Attach the inner wire to the derailleur clamp and, pulling the inner cable taut, tighten the clamp bolt. Adjust rear cable tension as described previously.

9 CHAIN JUMPING ON SPROCKETS

Check the chain for wear with a chain wear checker tool. Or use a steel rule and measure the chain's pin to pin distance over 24 links. If it is greater than 308mm, the chain is worn and needs replacing. Changing the chain a little earlier, at 306mm, will probably obviate the need for a new cassette. Chain replacement is dependent on chain type (see the separate guide to 10/11-speed chains on page 54).

If the chain is worn beyond the above limits, the cassette will probably be worn excessively as well and will need replacing at the same time as the chain. Slide the correct lockring tool into place and check that it is properly engaged in the splines. Refit the quick release and tighten sufficiently to keep the lockring tool fully seated in the splines of the lockring. With the wheel vertical, place the chain whip on the left side of one of the larger sprockets. It should be positioned so that its handle is just above the horizontal.

Make sure that the chain is securely wrapped around the sprockets' teeth and that the short piece of chain on the chain whip is also fully engaged. Put a little pressure on the chain whip's handle to tension the chain. Fit a large adjustable spanner to the lockring tool so that its handle is horizontal or just above on the right-hand side. Push down on both the chain whip and adjustable spanner firmly. The lockring should loosen easily. Take care not to let the chain whip slip. Remove the wheel's quick release. Loosen the lockring completely and remove it.

To fit a new cassette, align the triangular mark on top of the cassette body with the widest spline and slide on. It is very important to ensure that the spacers and shims all go in their correct position; it's easy to check by eye that all the sprockets are spaced identically apart.

ROAD / OFF-ROAD

BEGINNER

20 mins

None

CAMPAGNOLO MAINTENANCE

Campagnolo gears are a little different from Shimano. Here we explain how to clean, maintain and fine tune your Italian gears for the smoothest changes

When adjusting your gears it is essential to ensure that the chain is clean and that both it and the cassette are not excessively worn. Chain maintenance is covered on page 30 and cassette replacement on page 32. Cable condition is equally important. Cable sets should be replaced every two years or so as the casing can become worn inside. If the outers have been recently replaced and you just have a frayed inner cable it's normally fine to replace only the inner. Turn to page 16 to learn how to replace your gear cables. In the maintenance steps here we describe shifting the chain from the large chainring to large sprocket and small chainring to small sprocket. Note, you should never ride your bike with the chain in these gear combinations as the extreme crossing of the chain will cause more rapid wear to the chain, chainrings and sprockets.

1 CLEANING

Keep your derailleurs clean using a proprietary cleaner or white spirit in conjunction with an old toothbrush – an electric one is very effective. Lube the main parallelogram pivots with PTFE or a Triflon based lubricant. Wipe off any excess. Regularly check the outer cables for cracked or distorted casing, particularly at stops or the rear derailleur. Check the inner cables for fraying, particularly at the cable clamp bolts, and always ensure that a cable end is still fitted as they can drop off.

TIP

When refitting a rear derailleur or fitting a replacement, be very careful when screwing it into place. The threads are fine and can be easily cross-threaded. Ensure that the cage position plate is aligned correctly too.

5 CAGE POSITION

To check that your gears are set up correctly, shift onto the smallest sprocket and turn the cable adjuster fully clockwise then back-off one complete turn anti-clockwise. Back-off the cable adjuster on the down-tube completely. Loosen the inner cable clamp. Tighten the cage position screw (see photo). Visually check that the upper derailleur cage pulley is in line beneath the smallest rear sprocket. If not, adjust the limit screw until the pulley is in line with the sprocket. With pliers pull the inner cable taught and tighten the cable clamp.

6 TOP GEAR PULLEY ALIGNMENT

Visually check that the upper derailleur cage pulley is in line beneath the smallest rear sprocket. If not, adjust the top gear limit screw (top gear limit screw is the right hand one) until the pulley is exactly in line with the sprocket. With pliers pull the inner cable taught and tighten the cable clamp.

- ✓ Small cross head screwdriver
- ✓ 5 and 6mm Allen keys
- ✓ Rohloff Caliber or other chain checking tool or metal ruler
- ✓ Pliers

WORKSHOP WISDOM

If you have had an accident or the bike has been dropped on its right side, or if you continue to have shifting problems with the rear derailleur system after adjusting the gear, the mech hanger may be bent. Find a bike shop which has the special hanger alignment tool to check the rear hanger alignment. With the correct tool it is easy to check and correct hangers on steel frames. On aluminium frames the gear hanger is sometimes replaceable. With aluminium, titanium or carbon fibre frames it is essential that the bike shop you choose is experienced in your type of frame.

2 CHAIN AND SPROCKETS

Most modern chains do not like being separated, so clean the chain in situ using one of the clip-on chain cleaning devices. It's a good idea to remove the cassette for cleaning, otherwise it is all too easy to get cleaning fluid into the hub bearings. The cassette can be soaked in cleaning fluid in a dish. Check the chain for wear with a chain wear tool, such as the Rohloff Caliber, or by measuring 24 links (rivet centre to rivet centre). If it is 308mm (12 1/8in) or longer, the chain is worn out and should be replaced together with the cassette.

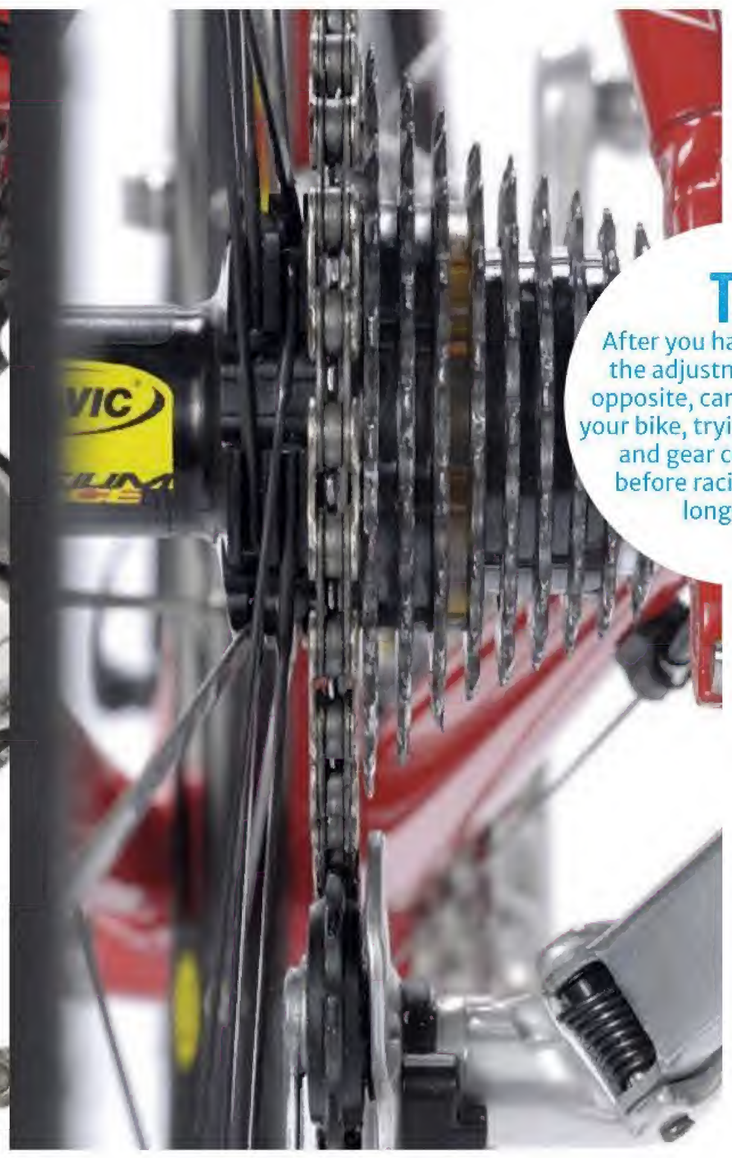
FRONT DERAILLEUR

3 DERAILLEUR CAGE HEIGHT AND ALIGNMENT

Shift the chain onto the largest chainring. Check that the derailleur cage is about 1-2mm above the chainring and that a centre line along the derailleur cage runs parallel to the chainrings. Adjust if necessary by slackening the derailleur fastening bolt by about two turns so that you can easily move the derailleur upwards and downwards and from side to side. Tighten the derailleur mounting bolt and check that the derailleur cage does not touch the outer chainring.

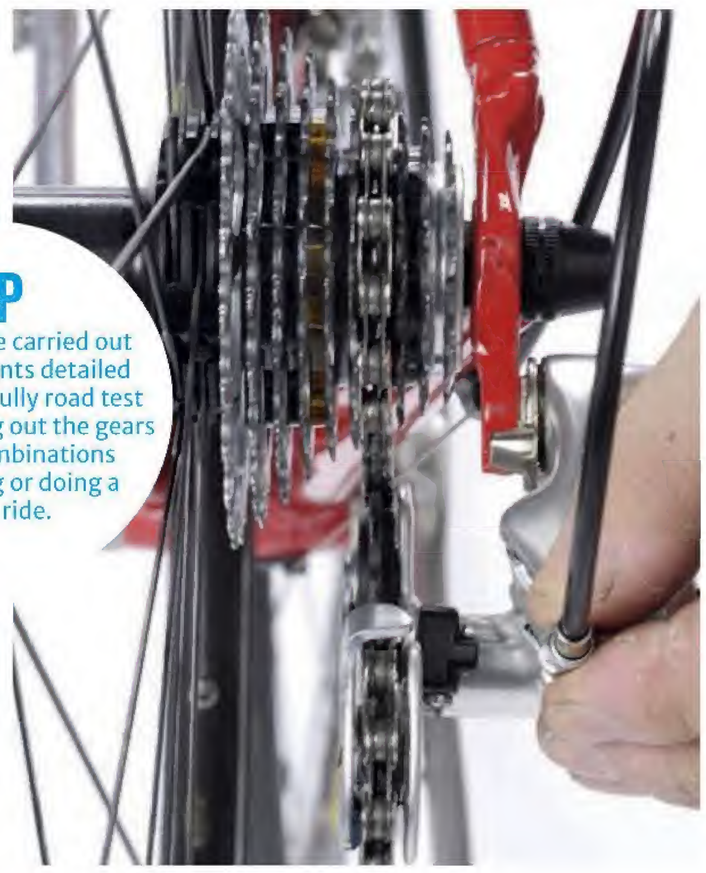
4 CABLE AND STOP ADJUSTMENT

Shift the chain onto the largest rear sprocket and smallest front chainring. The inner plate of the cage should be about 1mm from the chain. Adjust the low limit screw (normally the inner or upper one) as necessary. Slacken the gear cable fastening bolt, pull the gear cable taught and refasten the cable fastening bolt. Shift onto the smallest sprocket and large chainring. The outer plate of the cage should be about 1mm from the chain; adjust if needed with the outer or lower limit screw.



TIP

After you have carried out the adjustments detailed opposite, carefully road test your bike, trying out the gears and gear combinations before racing or doing a longer ride.



7 LOW GEAR PULLEY ALIGNMENT

The low gear (large sprocket) limit screw is the left hand screw. Shift into the lowest gear (largest rear sprocket). Visually check that the upper derailleur cage is in line beneath the largest rear sprocket. If not, adjust the limit screw until the pulley is exactly in line with the sprocket. Now shift to a couple of smaller sprockets and back again to check that the chain does not overshift the largest rear sprocket.

8 INDEX ADJUSTMENT

Change onto the fourth smallest sprocket. Check that the pulley is perfectly aligned with the centre line of the fourth sprocket. Turning the cable adjuster anti-clockwise will move the pulley inwards and turning the adjuster clockwise moves the pulley outwards. Once the pulley is perfectly aligned, check that the chain smoothly shifts one sprocket at a time across every gear of the cassette when on both the smallest and largest chainrings.

ROAD

OFF-ROAD

BEGINNER EXPERIENCED EXPERT

60 mins

£200+ for components

INSTALLING SRAM GEARS

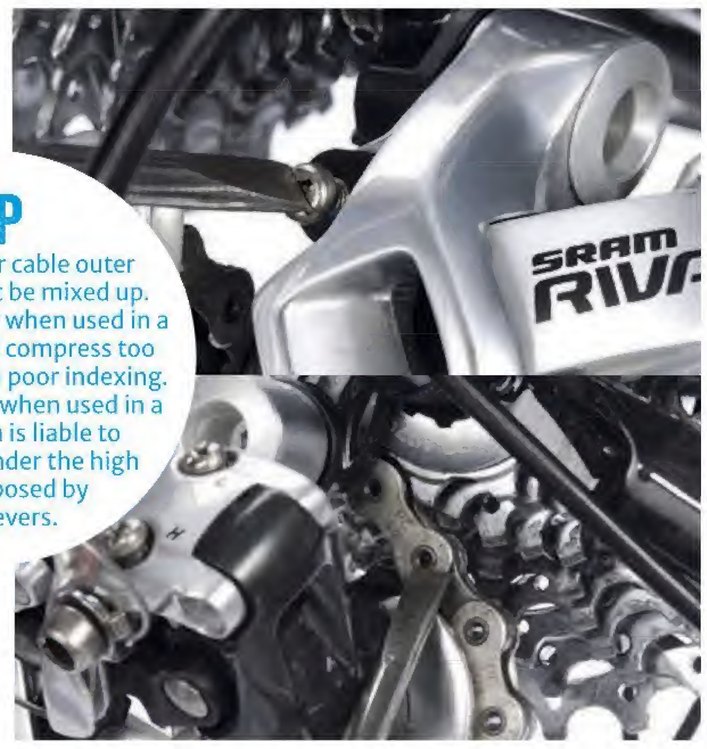
How to fit a complete set of mechanical SRAM gears and get them shifting perfectly

SRAM transmissions have a big presence on road bikes and SRAM made an impact with its DoubleTap integrated shifters. SRAM cassettes and chains are interchangeable with Shimano 10 and 11-speed, but the rest of the components are not interchangeable with Shimano.

Here's how to install a new set of mechanical (as opposed to hydraulic) SRAM gears, get them properly set up and running smoothly.

1 FITTING THE SHIFTERS

Pull the shift lever hood cover away from the body to expose the 5mm clamp fixing bolt. Loosen the bolt sufficiently that the shifter will slide easily onto the bars. Slide the shifter onto the handlebar in the approximate position. Repeat for the other side. Gently tighten the fastening bolts. Sit on the saddle and double check position of the levers and adjust if necessary. Check with a straight edge positioned on the top of the shifters that the levers are level and then check that they are in line with the frame before tightening their fastening bolts fully.



TIP

Brake and gear cable outer casing must not be mixed up. Brake cable outer when used in a gear system will compress too much resulting in poor indexing. Gear cable outer when used in a brake system is liable to disintegrate under the high forces imposed by brake levers.

5 BRAKE CABLE FASTENING AND CHAIN LENGTH

Pull the brake lever on – the brake inner wires feed through the countersunk hole, which is then exposed. Cut brake outer cable to the right length with side cutters and then feed the brake cables through the cable housings and stops. Attach to the brake calliper cable clamp and pull the inner cable snug. Ensure the cable nipple is firmly seated in the cable holder in the lever. Tighten the brake cable clamp and adjust the brakes. Bypassing the rear derailleur, run the chain around the largest sprocket/large chainring combination. Chain length should be adjusted such that it is two links longer (with the connecting link) than the minimum length to go around the large sprocket and large chainring.

6 CHAIN GAP AND B-TENSION SCREW

Chain gap is the distance between the upper derailleur pulley and the sprocket the chain is on. Optimal chain gap is small enough to allow quick, efficient shifts, but large enough for smooth shifts to and from the largest cog. Shift the chain onto the smallest chain ring and check the chain gap. While turning the crank, push the rear derailleur by hand to the largest cog and check the chain gap in this position. Adjust the B-adjust screw until the minimum chain gap in either position equals approximately 6mm.

7 LIMIT SCREWS ADJUSTMENT

Check the rear derailleur and pulleys from behind. Turn the limit screw marked H on the derailleur to align the upper guide pulley centre with the outboard edge of the smallest sprocket. Anti-clockwise moves the derailleur pulley towards the frame. While turning the crank, push the rear derailleur onto the largest sprocket by hand. Align the upper guide pulley under the largest sprocket, centre to centre, by turning the limit screw marked L on the derailleur; anti-clockwise moves the derailleur pulley inboard towards the spokes.

- ✓ Small crosshead screwdriver
- ✓ 5 and 6mm Allen keys
- ✓ Pliers
- ✓ Cable cutters
- ✓ Side cutters

WORKSHOP WISDOM

Ferrules are an essential part of any cable system, preventing the outer cables from splaying apart and reducing the effort needed to turn cable adjusters. They should be a snug fit on the outer cable and a reasonably close fit in the stop or adjuster. Outer cables will normally come with ferrules already fitted. It is a good idea to buy some extra ones as you may need to shorten the outer, or the ones already fitted may not fit the stops on your bike.

2 FITTING THE DERAILLEURS

Fit the rear derailleur with a 5mm Allen key to the dropout, taking care to get the B-tension screw and its plate in the correct position – see the photo. Be careful threading it into place as the threads are fine and easily crossed. Mount the front derailleur either on the frame braze-on or with a clip. Adjust the height of the derailleur so that clearance between the front derailleur cage and the large chainring is 1-3mm. Align the front derailleur cage outer plate's trailing edge to be toed outwards slightly. Finally, tighten the 5mm Allen bolt to hold it in place.

TIP

Always make sure you fit cable caps to the ends of all inner cables.

3 FITTING THE GEAR CABLES 1

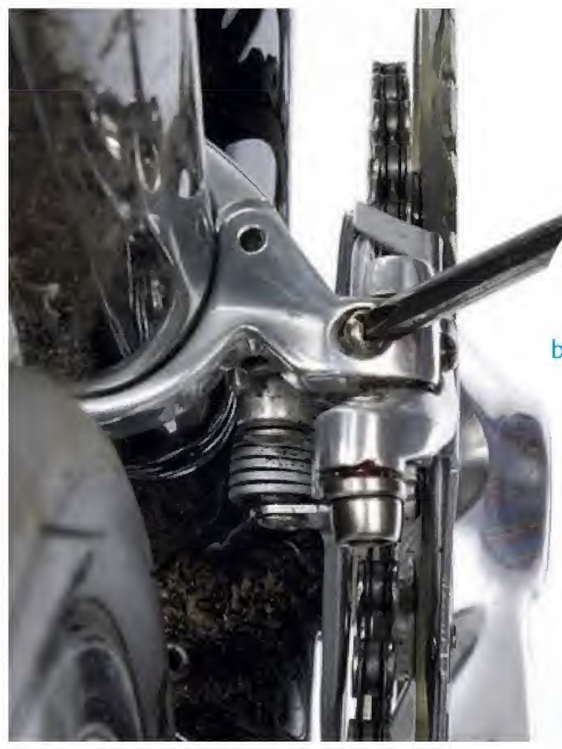
Feed the gear cables into the lower of the two holes on the side of the lever body. The photo shows where the cable enters the body and where it exits. The cable requires a little more force than you might expect, as it has to bend almost immediately it is inside the shift lever. Lay the outer gear cable in position to the shifters along the bars and to the adjuster on the frame or an in-line cable adjuster. Make sure the outer cable length allows the bars to be turned fully in either direction with just a hint of spare cable. Trim the outer cables if needed with cable cutters.

4 FITTING THE GEAR CABLES 2

Fit the inner cable through the outer and, ensuring the outer is tightly in the lever body, tape it in place on the bars. Cut a length of outer cable to run from the chainstay stop to the derailleur – not so short that the curve is too tight. Now feed the inner cable back to the derailleurs. Ensure the rear shifter is in top gear and the front shifter set for the small chainring so the cables are fully released. Turn the rear derailleur barrel adjuster fully clockwise, then anti-clockwise by one turn. Thread the cable through the rear derailleur barrel adjuster and around the cable guide.

8 REAR GEAR INDEXING

Shift onto the smallest rear sprocket. Pull the cable taught and position it under the cable anchor washer. Tighten the 5mm Allen bolt. Shift the chain and derailleur up and down the cassette several times. Shift the chain to the smallest sprocket. Turn the cranks forward and move the shifter up one click. If the chain hesitates or does not shift to the second sprocket, increase the cable tension by turning the derailleur barrel adjuster anti-clockwise. If the chain shifts beyond the second sprocket, decrease the cable tension. Repeat the two former steps until the shifting is smooth and accurate.



TIP

After you have fitted your gears or adjusted them, carefully road test your bicycle, trying out all the gears and gear combinations before racing or doing a longer ride.

9 FRONT DERAILLEUR LOW LIMIT ADJUSTMENT

Shift the chain onto the largest rear sprocket and the small front chainring. Adjust the low limit screw so that the chain is as close to the inner cage plate as possible without actually touching it. Make sure the shifter is set in the slackest cable position. Slacken off the frame cable adjuster (or in-line adjuster) and then tighten one turn. Fasten the inner cable under the cable anchor washer and hold taut, tighten the 5mm Allen bolt. Shift the chain up and down the chainrings to take out slack in the cable. If necessary re-tension the cable and tighten the cable anchor bolt.

10 FRONT DERAILLEUR HIGH LIMIT AND INDEX

Shift the chain to the smallest rear cog and the large front chainring. Adjust the high limit screw so that clearance between the front derailleur cage outer plate and the chain is about 1 mm. Next set the index shifting adjustment. Shift the chain onto the largest rear sprocket and small chainring. Make sure the left shifter is set in the middle position. If the chain scrapes against the inner cage plate, turn the adjusting barrel on the shifter clockwise until the chain shifts smoothly and is free of obstruction.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

30 mins

£3-£30 for cables as required

FRONT DERAILLEUR FITTING AND MAINTENANCE

Front derailleurs are simple to fit and adjust. We show you how to get them working right

If replacing a front derailleur on its own it is essential to buy the correct replacement, and this can be complicated.

Front derailleurs come in different versions to suit different chainring combinations, frames, shifters, chain types and cable runs.

With road bikes, front derailleurs are available for compact (typically 50/36T or 50/34T) chainrings and standard double chainring combinations, and also for triple chainrings set-ups.

Braze-on or clamp-on fittings are available for several sizes of seat-tube: steel frames take 28.6mm, while 31.8mm and 34.9mm are available for use on aluminium and titanium framed bikes.

Almost all road bikes use cable run from below, but it's common practice on cyclo-cross bikes to use a cable from above. An MTB front derailleur will probably be needed here.

Shimano road STI shifters can only be used in combination with a front derailleur designed to work with them; Shimano MTB front mechs will not index properly with the left-hand STI lever but can be used with down-tube or bar-end shifters.

10-speed front derailleurs may not always work with 11-speed chains. You need to check with the manufacturer's websites: http://cycle.shimano-eu.com and http://www.campagnolo.com/home.php

3 SMALL RING LIMIT, CABLE FITTING

With the rear derailleur shift the chain onto the largest rear sprocket; move the chain by hand to the inner chainring. The outer limit screw is normally the high gear stop and the inner limit screw the low gear stop. Check on your own derailleur. Adjust the low limit screw so that the inner plate of the cage is about 1mm from the chain. Back off all the adjustment on the down-tube adjuster. Attach the cable to its clamping and pull through until there's no slack and then firmly tighten the bolt, checking that the cable is routed correctly through the clamp.

4 BIG CHAINRING LIMIT AND FINAL CHECKS

Shift the rear derailleur on to the smallest sprocket and with the front derailleur shift the chain onto the large chainring. Adjust the high limit screw so that the outer plate of the cage is about 1mm outboard of the chain. Now check the shifting at the extremes on the rear derailleur with the chain on both the smallest and largest sprockets. Check that there is no chain rub at these extremes on the front derailleur cage and that the chain does not overshift the small or large chainrings.

5 CABLE ADJUSTMENT ON SHIMANO TRIPLES

Move the chain onto the middle chainring and largest rear sprocket. Adjust the cable tension with the down-tube adjuster so that the clearance between the derailleur's cage inner plate and the chain is between 0.5 and 1mm. Click the front STI lever one click so the chain moves outboard a little. With the rear derailleur select the smallest rear sprocket. Check that there is about 1mm of clearance between the chain and inner plate of the derailleur cage. If not readjust the cable tension (1/8 or 1/4 turn) of the down-tube adjuster and then recheck the clearance when the front derailleur is in the inner trim position and with the chain on the largest rear sprocket.

- ✓ Small cross head screwdriver
- ✓ 5 and 6mm Allen keys
- ✓ New inner/outer cables as required

WORKSHOP WISDOM

Shimano triple road systems are indexed and when the chain is on the middle chainring there are two positions for the front derailleur in order for the chain not to rub on the front derailleur cage when it is on the smaller or larger rear sprockets. Setting this up is described in step 5.

1 FRONT DERAILLEUR FITTING

Before doing anything, make certain that you have the correct front derailleur for the rest of your drivetrain and your frame. Loosen the cable clamp bolt and remove the derailleur's cage bolt and spacer. Slide the derailleur cage over the chain. If fitting to a braze-on, bolt the derailleur into place, tightening the fixing bolt to hold it firmly in place. With a front derailleur fitted with a clip to the tube, open the clip, fit the derailleur into place and tighten the clamp. Do not use any tape between the derailleur clamp and tube.

2 FRONT DERAILLEUR POSITION

Push down on the cable operating arm so that the cage moves outwards over the outer chainring. Loosen the derailleur's fixing bolt and position it so that the outer cage clears the big chainring by 1-3mm. Turn the derailleur so that a centre line along the cage runs parallel to the chainrings. Tighten the derailleur mounting bolt and check that the derailleur cage does not touch the outer chainring. Finally tighten the derailleur's seat-tube clamp bolt firmly but not too tightly; some tubes are very thin and can easily be crimped by an overtightened front derailleur clamp.

6 FRONT DERAILLEUR MAINTENANCE

Clean the derailleur with a degreaser and apply a little lube to the parallelogram pivots. Wipe off any excess. Check the height of the derailleur as in step 2 and its alignment with the chainrings. Check the derailleur's stops are set correctly (steps 3 and 4). Check the inner cable for fraying at the clamp and replace if necessary as in step 7. Check the shifting of the front derailleur with the chain on both the smallest and largest sprockets on the cassette as in step 8. There should not be chain rub on the front derailleur cage at the extremes.

TIP

After you have made the adjustments, road test your bike, trying out all the gears and gear combinations before a race or longer ride.

7 CABLES

Cable condition is critical to your gears working correctly. Check the outer cable from the STI or Ergopower lever to where it is fitted to the stop on the frame. Renew both the inner and outer gear cables if they have not been recently replaced. They only have a finite life which can be between a year and two year's use. If they are reasonably new check the inner cables for fraying, particularly at the cable clamp bolt. Ensure that the inner cable always has a cable end cap fitted – frayed cable ends sticking into your calf can be especially painful!

8 FRONT DERAILLEUR FINAL CHECKS

Shift onto the largest rear sprocket. Check that under repeated shifting from the largest to the smallest chainring the chain shifts without hesitation, but does not overshoot the small chainring inwards. If necessary adjust the low gear limit screw half a turn at a time either to make the shifting cleaner (anti-clockwise) or to prevent overshifting (clockwise). Shift into the smallest rear cog. Repeatedly shift onto the biggest chainring, adjusting the high limit screw half a turn at a time until it does so without hesitation but does not overshoot the largest ring.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

30 mins

£15 and up for a new chain

FITTING 10/ 11-SPEED CHAINS

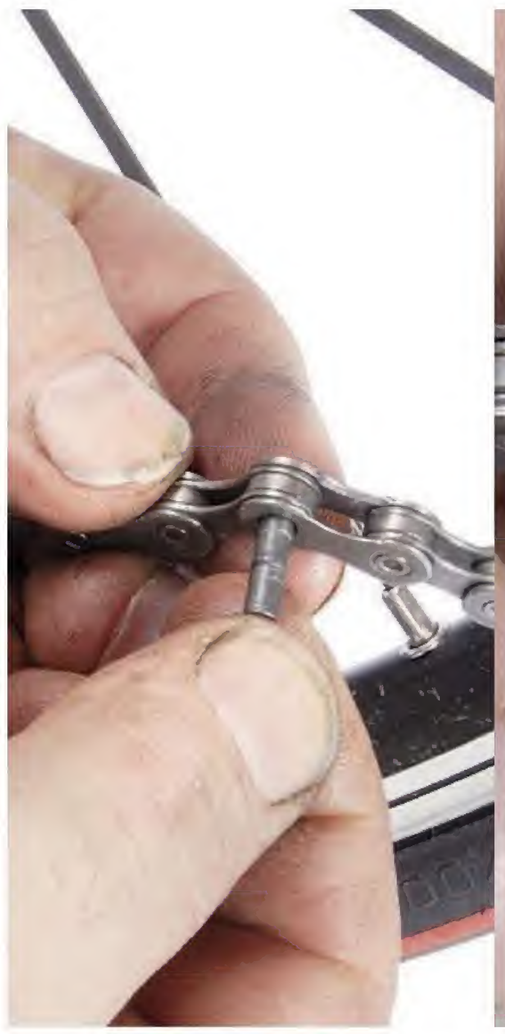
10 and 11-speed chains are standard on mountain bikes, and 11-speed on road bikes, but their ease of fitting varies depending on manufacturer. Here's how to deal with different types

Most road bikes feature 11-speed gears as standard and several specialist chain manufacturers now offer chains that are compatible with Shimano, SRAM and Campagnolo systems. 10 and 11-speed drivetrains are the norm on mountain bikes, with 12-speed on high end MTBs.

Before you start

- Always read the chain manufacturer's instructions first and follow them scrupulously.
- Correct chain length is important: chains which are too short can cause damage to the derailleur and, in extreme cases, the frame. Chains that are too long may mean that the gears do not work as smoothly. If your old chain length was correct, shorten the new chain to the same length.
- A Shimano 9-speed chain can be used in a Campagnolo 10-speed system, but not an 11-speed system; and it will need the special Shimano pin to be joined but does not need a special chain tool for shortening.
- Your chain will wear out faster and need replacing before the cassette does, so a great help to maximising cassette and chain life is to buy three new chains when replacing the cassette. As a general rule for a road bike, after 500 miles, replace the first chain with the second. After a further 500 miles replace the second with the third. After the next 500 miles, replace the third chain with the first and so on, rotating the chains every 500 miles

With aluminium cassettes, reduce the distance to 250 miles between rotations. Very high mileages can be obtained this way while still maintaining transmission efficiency.



3 SHIMANO JOINING

Shimano recommends that the chain should be joined so that the pin goes through the outer link at the forward end in relation to the direction of rotation – this apparently makes the joint stronger. Push a Shimano connecting pin pointed end first through the outer and inner links of the chain. Put the link in the special Shimano chain tool. Tighten the chain link extractor pin on the rivet end, driving it into the two halves of the chain link. Continue tightening until the fatter rivet section of the pin protrudes equally either side of the outer link. Snap off the protruding guide section with a pair of pliers. Check that the rivet projects evenly. Check that the link pivots freely: if not, flex the link sideways gently in order to free the chain's movement.

4 SRAM JOINING

The chain should be shortened so that there are two inner link ends. With the inner link ends in the lower run of the chain, insert both halves of the PowerLock link, developed for 10-speed chains, into the chain ends. Pull apart the chain with your hands until you feel some resistance. Turn the chainwheel to bring the PowerLock link into the upper run of the chain. Holding the bike still, put all your weight on the pedal until you hear the link click. SRAM states that each PowerLock is good for a one-time application only because of the especially tight tolerances of 10 and 11-speed drivetrains.

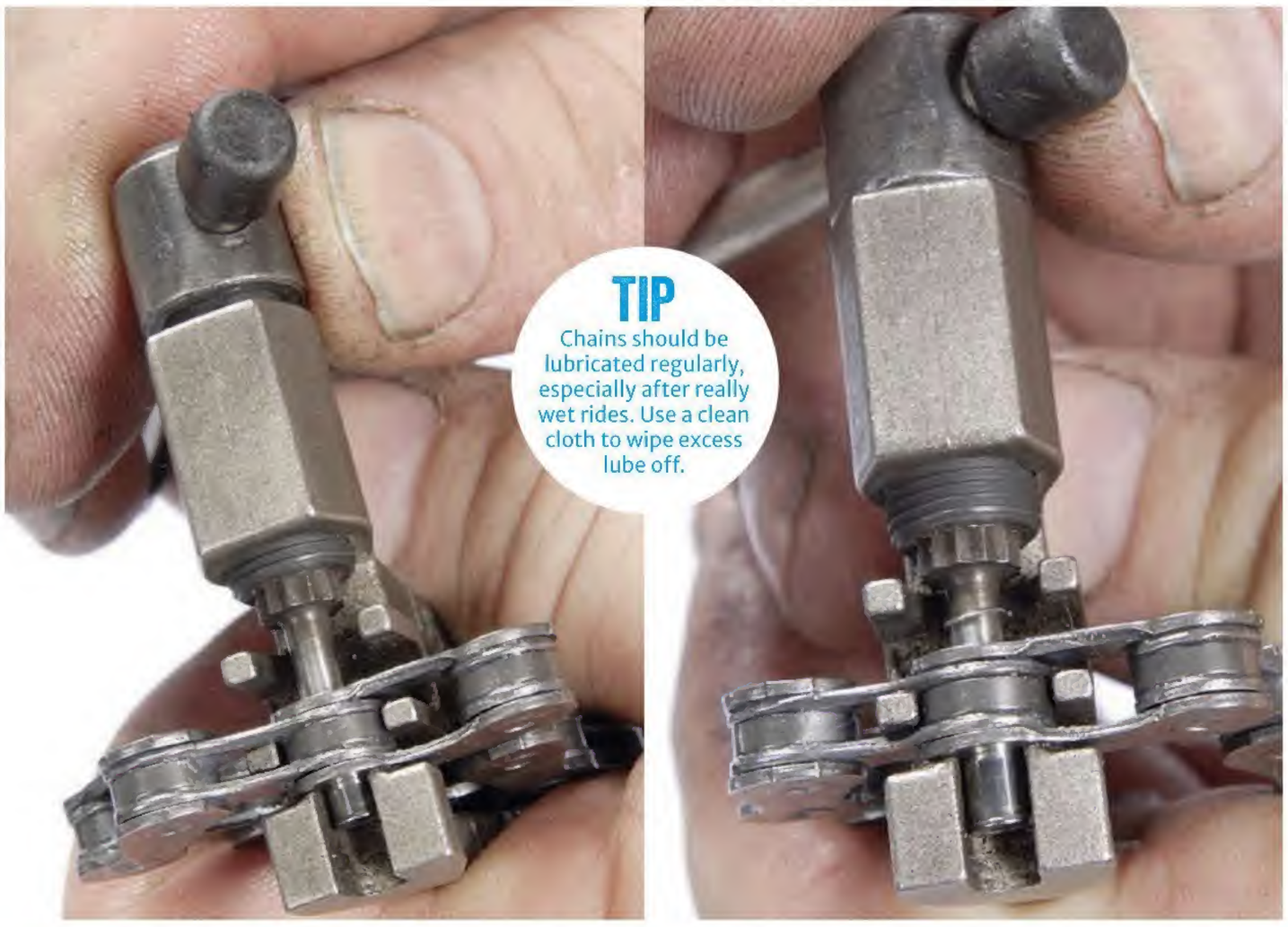
✓ Chain rivet extractor (Shimano chains require a TL-CN27 extractor; Campagnolo the UT-CN200)

WORKSHOP WISDOM

Check for chain wear using a chain wear indicator tool. When replacing a worn chain you will sometimes find that you have to replace the cassette as well. Check the chainrings at the same time for excess wear, but remember chainrings should normally last the life of several cassettes.

1 CHAIN LENGTH

Shimano's method works well. Shift the rear derailleur onto the smallest sprocket and the front derailleur onto the largest chainwheel. Feed the new chain (inner link end) into place around the largest chainwheel, around the smallest rear cassette sprocket and then over the top of the first pulley and behind the lower pulley. Pull the other end (outer link end, sometimes with rivet) of the chain dead tight against the inner link end so that the rear derailleur cage is vertical. Mark the nearest outer link. This is the point to which the chain is shortened. This method produces a very similar result to that used by Campagnolo. SRAM prefers to wrap the chain around the largest rear sprocket and the largest chainwheel then shorten it so that the chain is longer by a link than the shortest it could be.



TIP

Chains should be lubricated regularly, especially after really wet rides. Use a clean cloth to wipe excess lube off.

2 SHORTENING A CHAIN

This method applies to all chains, although for a Shimano 11-speed chain you will need a Shimano 11-speed compatible chain tool. Fit the chain link extractor so that the chain lies in the furthest slot from the screw handle. Holding the chain in place with your finger, line the screw pin up with the chain rivet and tighten the chain rivet extractor until it pushes the rivet through the chain link. Continue screwing until the rivet is pushed all the way through. Chains with special links will need two inner link ends left; a Shimano chain joined with a special pin requires outer and inner link ends.

5 KMC JOINING AND OPENING

Working with KMC chains is slightly different again. The chain should be shortened so that there are two inner link ends. Fit both ends of the MissingLink into the chain ends. Press both halves of the MissingLink together and lock them together by pulling apart. To open the chain, press both plates of the MissingLink together while pushing the chain ends towards each other. We found the MissingLink to be the easiest to use and it can be reused if you're careful.

6 WIPPERMAN CONNEX JOINING AND OPENING

Shorten the chain so that there are two inner link ends. Fit the pin of the first half Connex-link into one inner link and the second half into the other inner link but from the other side. Turn both halves of the Connex-link through 90 degrees and push both halves into each other. Straighten the chain section containing the link and pull apart firmly. To open the chain, turn the Connex-link to 90 degrees to the rest of the chain. Push the two ends of the chain connected by the Connex-link together. Carefully pull the two ends apart sideways and the chain is opened. This also worked very easily and the Connex-link can be reused.

7 TAYA JOINING AND OPENING

Shorten the chain so that there are two inner link ends. Connect the two inner links with half of the Sigma link that has the pins. Place the other plate over the end of one pin, rotate the plate until it is over the second pin and gently flex the chain by pushing with your thumbs until the second connector snaps into place on the pin. You may find you need a pair of pliers to push the link into place. Check the plate is fully seated on the pins of the first plate: both plates should be perfectly parallel to each other. To open the chain, find the connecting link and, with the plate without the pins nearest you, grasp the chain four to five links away from the connector each side. Flex the chain by pushing with your thumbs. The link will disconnect. It should not be reused. This link is not as easy to use as the KMC MissingLink or Wipperman Connex-link.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

15 mins

£16-300 for new cassette

FIT A NEW CASSETTE

Here we show you how to remove and replace your cassette, whatever the brand, and show you how it goes together and can be modified

Good chain maintenance, as described on page 30, will help to prolong a cassette's life.

If you fit a complete new cassette you should replace the chain; if not, your expensive new cassette will have a much shorter lifespan.

With cassettes where spare sprockets are available, it can often be more economic to just replace the more heavily worn sprockets, which are generally the smaller ones. However, if your cassette has seen quite a fair few thousand miles, it may actually be cheaper to replace the whole cassette together with the new chain.

Before you start

- Campagnolo 8-speed cassette sprockets are spaced at 5mm, 9-speed at 4.55mm, 10-speed at 4.12mm and 11-speed at 3.8mm.
- Shimano and Sacha 7-speed cassettes are spaced at 5mm. Shimano and SRAM 8-speed are spaced at 4.8mm, 9-speed at 4.34mm, 10-speed at 3.95mm and 11-speed at 3.74.
- This means that your cassette must be correctly spaced for your gearing system if all the gears are to index correctly.
- Cassettes which do not group sprockets together on spiders can be customised using either sprockets from other cassettes made by the original manufacturer or from a third party.

Shifting performance may suffer a little when mixing sprockets from different cassettes, as the shift gates will not necessarily be in the optimum position. You will need to experiment to see what you are prepared to put up with. As long as you keep the sprocket spacings correct though, this will normally be acceptable and run without any annoying issues.

4 SHIMANO CASSETTES

Shimano cassettes come in quite a few different varieties. With almost all 7- and 8-speed cassettes, five or six sprockets will be held together by miniature Allen screws. These can be undone with the correct Allen key; sometimes it's a 1.5mm Allen key and occasionally something even smaller. The Allen screw heads can be on the front or rear face of the sprocket group. The cheaper 9-speed cassettes are joined similarly. The more expensive 9, 10 and 11-speed cassettes will have sprockets mounted on spiders in groups of two or three together with spacers in between. On some Mavic hubs, spacers will need to be mounted before fitting a Shimano cassette. Spacers are also needed if you are mounting a cassette with a smaller number of sprockets than the hub is designed for.

5 CAMPAGNOLO CASSETTES

All current Campagnolo cassettes are 10 or 11-speed, though 9-speed cassettes are still available as spares. With Xenon, Mirage and Veloce, the cassettes are composed of single sprockets with spacers in between. With Centaur, Chorus and Record, the sprockets are mounted on aluminium carriers in groups of two or three except for the smallest three sprockets. The sprockets must be mounted so that the size markings face outwards on the freehub body.

6 MARCHISIO CASSETTES

These are available for both Campagnolo and Shimano cassette bodies and with spacers to suit 7 to 11-speed systems. There are two varieties, ones using adaptor pieces and ones which mount directly on the freehub body. All sprockets are single and, apart from the smallest sprocket, they are fully interchangeable. This means that you can easily customise the cassette to suit you and your riding. Unlike all the other cassettes, the size markings here should face inwards when mounted on the freehub body.

✓ **Lockring tool**
✓ **Chain whip**
✓ **Allen keys, including 1.5mm if dismantling some Shimano cassettes**

WORKSHOP WISDOM

Spacer kits are available (around £20) to respace any Shimano or Campagnolo cassettes from 5mm to 4.8mm, 4.55mm and 4.35mm spacing and vice versa, as long as none of the sprockets are mounted on a spider. Sturmey Archer sprocket spacers can also be useful when re-spacing a cassette.

1 LOCKRING TOOL FITTING

Undo your brake's quick-release and then remove the rear wheel by opening the wheel's quick-release lever. Remove the wheel's quick-release from the hub by unscrewing the knurled nut on the opposite end to the lever. Slide the correct lockring tool into place and check that it is properly engaged in the splines. Refit the quick-release without its conical springs and tighten sufficiently so that it will keep the lockring tool fully seated in the splines of the lockring as you undo it.

2 LOOSEN THE LOCKRING

With the wheel vertical, place the chain whip on the left side of one of the larger sprockets. It should be positioned so that its handle is just above the horizontal. Make sure that the chain is securely wrapped around the sprockets' teeth and that the short piece of chain on the chain whip is also fully engaged. Put a little pressure on the chain whip's handle to tension the chain. Fit a large adjustable spanner to the lockring tool so that its handle is horizontal, or just above, on the right hand side. Push up on both the chain whip and adjustable spanner firmly. The lockring should loosen easily. Take care not to let the chain whip slip.

3 REMOVING THE CASSETTE

Remove the wheel's quick-release. With the lockring tool, loosen the lockring completely and remove it. Lift off the sprockets and lay out all the sprockets and spacers in the same order as removed on your bench. Even with cassettes where sprockets are grouped together on aluminium carriers or spiders, there will often be spacers between the carriers. It is very important that the spacers are replaced in the correct position.

7 REPLACING THE CASSETTE

With all cassettes, except Marchisio, the size markings should face outwards. With Shimano cassettes, align the triangular mark on top of the cassette body with the widest spline and slide on. With the Campagnolo cassettes with sprockets mounted on aluminium carriers, align the support up with the splines on the freehub body and slide the cassette onto the freehub body. With all cassettes, Shimano or Campagnolo, it is very important to ensure that the spacers and shims all go in their correct position. It's easy to check by eye that all the sprockets are spaced identically apart.

8 FITTING AND TIGHTENING THE LOCKRING

Once all the sprockets are fitted, check that the top gear-sprocket stands slightly proud of the freehub body – if not, you have missed out a spacer or shim. Fit the lockring using the lockring tool. If you have one, refit the quick-release without its conical springs and tighten the lockring with an adjustable spanner until you hear or feel three or four distinct clicks. Remove the quick-release. Refit the quick-release's conical springs and refit the quick-release to the wheel.

9 CUSTOMISING YOUR CASSETTE

With Shimano cassettes where the sprockets are held together by Allen screws, or Campagnolo cassettes with individual sprockets, it is possible to change sprockets to build a cassette with custom ratios. With a vernier calliper, first measure the width between the centreline of the sprockets on your existing cassette. Build your cassette up on the hub, fitting the replacement sprockets where you wish. Try to take into account any differences in spacer or sprocket thickness as you go by using appropriate spacers to keep the inter-sprocket width the same. Once all the sprockets are fitted, check that the top gear-sprocket stands slightly proud of the freehub body. Fit the lockring and tighten as described in step 8.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

30 mins

From £20 for new BB

FITTING BB30 AND BB90

Press fit BB30 and BB90 bottom brackets are pretty standard items these days, we show you how to remove and install new ones

For a long time the square taper bottom bracket was the standard, but there has been a proliferation of systems in the last few years, with BB30 now leading the way. This was developed by Cannondale, and has very large bearings that press straight into the frame. This has been followed by the Shimano Press Fit system, loosely referred to as BB90, and both are appearing on a wide variety of road and mountain bikes. They're effective and seem reliable. There aren't many budget aftermarket tools to service them, but you might as well get familiar with the ones there are as this system's here to stay. If you've ever ridden BMX bikes and fixed them yourself, you can dust off your hammer and blocks of 2x4.

1 DIAGNOSIS AND REMOVAL

To spot problems with press fit bottom brackets, drop the chain out of the way to one side or the other so that it doesn't rub against the chainrings. Turn the cranks to feel for roughness or play; feel for sideways play at the pedal end of the arm. More than about 1mm, combined with roughness, means it's time to replace the bearings. Begin by removing the left arm, which on SRAM/Truvativ or FSA will usually require a 10mm or 12mm Allen key and possibly an extension bar. Reinstall the chain onto the big ring to protect yourself in the event of a slip, and work with the bike on the ground if necessary for better leverage. With Shimano, simply loosen the two 5mm pinch bolts, lift the safety latch and unscrew the retaining bolt.

5 REMOVE SHIMANO BEARINGS

Park Tools has a special tool for Shimano bearings, the BBT-90 (£44.99), which is a smaller version of its headset cup remover; it's just an expanding tube that you hit with a hammer. A drift made out of a length of alloy tubing or rod, ideally between 15 and 20mm in diameter, will also do the job. The bottom picture (above) shows the inner workings: there's not much to it, other than possibly an internal ridge or circlip which you should be careful to avoid. Note the sequence of crank, axle and cup assembly. The Shimano cups end up with a nominal width of around 90mm, thus the new (non-official but widely accepted) name of BB90; they work just like the threaded versions.

6 INSPECTION

Once removed but before cleaning, spend some time giving the bearings and surfaces a good looking over to check for signs of wear or corrosion. Notice the rust marks by the pointer. Water will most definitely work its way in and settle in a pool if it has no way out. Drilling a small drain hole in the bottom bracket shell is still a worthwhile step – although it is frowned upon by manufacturers and it could affect your frame warranty. Now prepare to reassemble or to install new bearings. Make sure that the circlips are still correctly seated in their respective grooves, which are located just inboard about 1cm from the outer edges of the bottom bracket shell. There is no need to remove them.

7 REINSTALL BEARINGS

The BB30 inner shell and crank spindle are usually aluminium, while the bearing races are steel, so grease can and should be used. If possible, support the bottom bracket on a wooden block while knocking in the bearings. Although not the 'approved' method, if done carefully while keeping them parallel they'll go in fine. The Park BBT-39 presses make life easier, but an old bearing or pipe drift will do it in a pinch, as long as it measures 41.5mm in diameter. Ensure that any wooden drift is properly flat, so that the impact is spread evenly through the entire surface of the bearing, and primarily the outer race; this will also avoid damaging the seal. Never press or drift in a new cartridge bearing by the inner race only.

- ✓ Allen keys up to 10/12mm
- ✓ Resin and rubber mallet
- ✓ Wood blocks and drifts, grease
- ✓ Multi-tool
- ✓ Torque wrench
- ✓ Park Tool BB30 tool BBT-39
- ✓ Park Tool HHP-2 or other headset bearing press
- ✓ Park Tool press fit cup drift BBT-90 or similar

2 CRANK REMOVAL

Drop your chain down off the inside ring; the whole right-side crank assembly might now simply push out. If not, give the protruding end of the spindle a decent tap with the mallet. Remove any dust caps, spacers or wavy washers and keep them in their correct order of position. With Shimano, pretty much the same method applies as with SRAM/Truvativ or FSA BB30s, although on some models the right-side crank arm and chainset unit comes off rather than the left. Hold onto the crank as it's being driven out to prevent it from dropping and getting damaged. BB30 cranks might require a bit more force and a sharper blow for removal than BB90 Shimano, which should normally just slide out with firm pressure.

3 BEARINGS REMOVAL

Because of the current scarcity of specific tooling available for this job, the methods used are no different than those for BMX bearing and one-piece crank removal; they seem somewhat primitive but they're an effective way of getting the job done. Knock out the bearing with a suitable drift. This can be a piece of narrow tubing or rod that fits into the bearing aperture and allows you to strike the inner edge of the bearing cup for Shimano or the inner race of a BB30 bearing, assuming both are needing replacement. The edge of the drift should be square enough for a good purchase without slipping. Angle it first to one side, strike a sharp blow, then angle to the other side, strike a sharp blow, and repeat until driven out.

4 REMOVE BB30 BEARINGS WITH SPECIAL TOOLS

These special tools still basically rely on brute force and impact to get the job done. They differ from a piece of hardwood and mallet in that they offer a bit more control and precision over the process. To use the Park Tool BBT-39, carefully angle it sideways in the bearing aperture to get the wide bit past the inner race as pictured on top; insert it until it comes into contact and is squared up against the inside of the bearing, avoiding any circlips or internal frame ridges. Now give it a couple of good sharp whacks with a resin mallet to dislodge the bearing. Make sure you position and protect your frame in such a way that it won't fall over and damage vulnerable tubing or paint.

8 PRESS IN BEARINGS

If you are fortunate enough to have some quality tools, such as the Park Tool HHP-2 headset press, this can now be used in conjunction with the bearing press plates included in the BBT-39 toolset. Position the headset press as pictured with the press plates up against the bearings and slowly tighten the press, ensuring it stays constantly aligned during the process. Press the bearings in until completely seated into the frame and bottomed out against the internal circlip stops. But don't overdo it, as these can be damaged if forced. With Shimano Press Fit the process is identical, but more force will be needed. Tighten until you see grease oozing from between the edge of the cups and BB shell, ensuring there are no gaps left.

9 REINSTALL ARMS AND TIGHTEN

Generously grease the spindle and insert the right side; tap in with a mallet but protect the finish with a bit of tape, as pictured (top). Grease the splined area of the spindle and reinstall the left crank arm, remembering the spacers. On SRAM/Truvativ and FSA, tighten up to about 40Nm. With Shimano, tighten the plastic cap into the left crank arm until it can no longer move inwards (it requires a light torque of just 0.7-1.5Nm). Allow it to settle between efforts. Replace the safety catch, then tighten the 5mm Allen pinch bolts gradually and evenly, remembering that when one is tightened, the other loosens. Finish to a torque of 12-14Nm each (about twice as firm as your stem/steerer clamp bolts).

10 TEST AND READJUST

Recheck the front derailleur adjustment – with some cranks this can change slightly. Check that the outer and inner stop screws allow correct shifting without chain drop-off. Now get on your bike, hammer through the gears and put some weight through the cranks by standing on the pedals and swinging the bike through the down strokes. This will bed everything down correctly, and there could be a little bit of play in the bearings after this test run. Recheck the crank arm bolt on SRAM/Truvativ and FSA, and don't be afraid to put some power into it to keep it from loosening over your next long ride. On Shimano, if play has developed, loosen the two 5mm clamp bolts, tighten the draw bolt a bit further then retighten the two 5mm bolts.

ROAD
OFF-ROAD

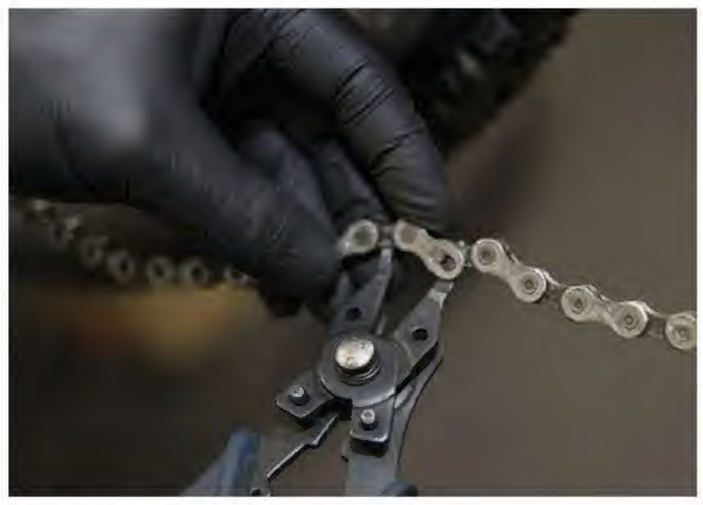
BEGINNER **EXPERIENCED** EXPERT

30 mins

From £20 for new BB

REPLACE YOUR BB92 BOTTOM BRACKET

Here's how to remove and replace another common press fit bottom bracket type - BB92



1 REMOVE THE CHAIN

Give your bike a good clean, then clamp it in a workstand. Use degreaser and a rag to make sure there's no dirt or grime left on the cranks or in the BB area. Use a pair of Power Link pliers (SRAM) or a chain tool (Shimano) to remove the chain, and place it to one side. If your bike has a chain guide, slide the guides out of the way.

4 CLEAN AND DEGREASE

Give the spacers a clean and set them down somewhere in the order they were removed. Give the cranks and the BB area of the frame another really good clean with degreaser and a rag. This is a good chance to give your chainring(s) a clean too.

5 COMPARE BBS

With the cranks removed, it's time to check you've got the right BB to replace the worn one with. SRAM cranks need a SRAM GXP BB92 BB and Shimano cranks need a Shimano BB92 BB. If your cranks are from another brand, measure the inside diameter of the worn non-driveside BB cup with a vernier calliper. If it's 24mm, a Shimano BB should do the job nicely.

6 REMOVE OLD BB

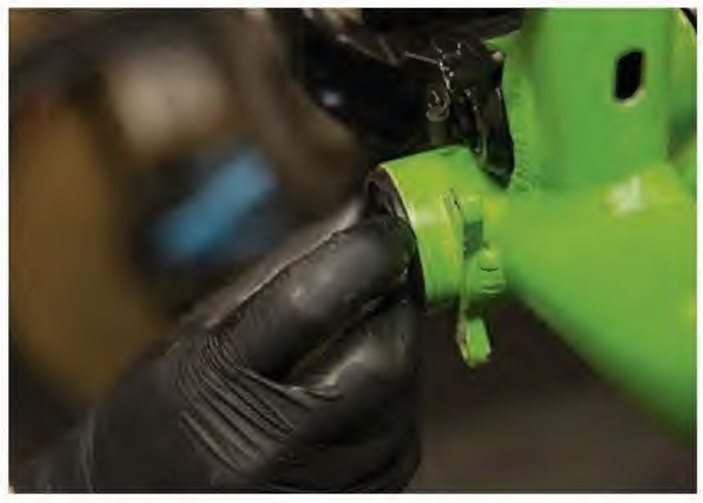
Insert the press-fit BB tool through the drive side of the BB, non splayed end first. As it slides through, the wings should splay out to sit against the bearing. If possible, get someone to brace the frame. Then, with the tool fully engaged, hit the protruding end carefully with a mallet from the non-drive side until the driveside bearing and cup come out.

10 GREASE BB

Sit one of the bearing press adaptors that comes with the press-fit BB tool against each cup. SRAM cranks will need the adaptor to be fitted backwards on the non-driveside cup so the force is applied across the bearing, not just on the inner race. Coat the BB's inner axle seal in grease, sit the cups in place on the frame, then slide the headset press through the BB shell.

11 PRESS IN BB

With the bearing press adaptors correctly orientated and the new BB cups sitting squarely against the frame, slowly turn the handle of the headset press clockwise to press the BB gently into the frame, constantly checking the alignment and that the cups are pressed into the frame as squarely as possible.



12 CHECK BB POSITION

When the lips of the BB cup sit against the edge of the BB shell, the installation is complete. Don't tighten the headset press unnecessarily, because this can damage the bearings. Wipe any grease away to check that the BB is fully pressed into place. Once you're sure all is good, undo the headset press and pull the tool from the frame.

- ✓ Headset press
- ✓ Degreaser
- ✓ Rubber/plastic mallet
- ✓ Vernier calliper
- ✓ Grease
- ✓ Chain tool or Power Link pliers
- ✓ 8mm Allen key
- ✓ 5mm Allen key
- ✓ Torque wrench
- ✓ Press-fit BB tool (Park Tool BBT-90.3 or equivalent)
- ✓ Shimano Hollowtech II end cap tool (Shimano FC16 or equivalent) – only needed if you have Shimano cranks
- ✓ Small flat-headed screwdriver
- ✓ Rags
- ✓ 17mm spanner
- ✓ Bike cleaner

WORKSHOP WISDOM

If there's play in the system or the bearings seem tighter than they should be after fitting a new BB, it's a good idea to remove and reinstall the cranks, checking that every washer or spacer is in the right place. If you're still having problems, ask your local bike shop for help.

BBs are the source of many an annoying creak. Making sure that all the surfaces are well covered in grease when installing a new one will lessen the chances of any irritating noises developing later.

It's a good idea to recheck the torque settings after the first ride with your new BB and keep an eye on how it wears – changing a totally shot BB can be a difficult job.

SHIMANO

OTHER

2A REMOVE CRANKS

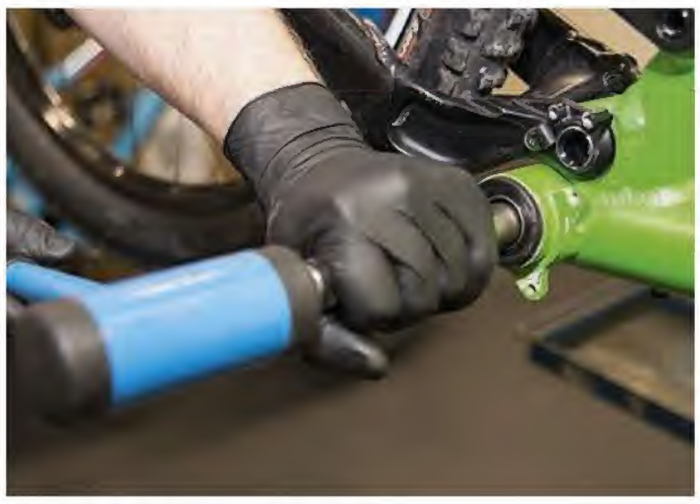
If you have Shimano cranks, first loosen both of the 5mm Allen key bolts on the non-driveside crank arm, turning them anticlockwise. Fit the Hollowtech II end cap tool and turn it anticlockwise to remove the end cap. Use a small screwdriver to disengage the security plate between the two clamping faces. The non-driveside crank should now pull off.

2B REMOVE CRANKS

If you have a Truvativ GXP or SRAM crankset, use an 8mm Allen key to undo the axle bolt in the non-driveside crank arm, turning it anticlockwise until the crank arm comes away from the axle.

3 TAP OUT AXLE

Tap the end of the axle with a plastic or rubber mallet to start it moving. You should now be able to remove the driveside crank arm and axle from the frame. Watch out for any falling spacers and make a note of where they came from and what order they were positioned in.



7 REMOVE OLD BB

With the driveside cup removed, insert the press-fit BB tool through the non-drive side of the BB and repeat step 6 to remove the non-driveside bearing and cup.

8 CLEAN INNER SHELL

If your BB proves particularly stubborn, it's worth taking the bike to your local bike shop for some expert advice – you don't want to wreck your frame, after all. With the old BB out of the frame, give the inner shell a good clean with degreaser and a rag. Check for any imperfections or marks on the press-fit surfaces.

9 GREASE INNER SHELL

It's installation time! To prepare the frame's BB shell, coat it in a generous helping of anti-seize grease. If you're installing a GXP BB, you'll need to make sure you install the BB the right way around. The cups have LH or RH marked on them – RH (Right Hand) being the drive side and LH (Left Hand) being the non-drive side, which has a smaller internal diameter.

13 REFIT CRANKS 1

Now get the BB ready for refitting the cranks. If it's a SRAM BB, cover the inner seals on both cups with grease before sliding the outer driveside seal on to the crank axle along with any other spacers and the spring washer you may have removed earlier. Cover the axle in a film of grease before pushing the driveside crank/axle assembly through the BB.

14 REFIT CRANKS 2

If it's a SRAM BB, fit the non-driveside seal before refitting the non-driveside crank arm. If it's a SRAM crankset, use a torque wrench to tighten the 8mm Allen key bolt to 50Nm. If it's a Shimano crankset, slide the non-driveside crank arm into place, reseat the security plate and refit the end cap, only doing it up finger tight. Torque the 5mm bolts to 12-15Nm.

15 FINAL CHECKS

Spin the cranks. They should move smoothly and easily, without resistance. Check for any play in the system by holding the frame in one hand, the end of a crank arm in the other and trying to force movement. If all is good, refit the chain using a new Power Link or joining pin, check the gears are properly adjusted and, where relevant, re-adjust the chain guide.

ROAD
OFF-ROAD

BEGINNER **EXPERIENCED** EXPERT

1-2 hrs

Approx £10 for grease

ISIS AND OCTALINK BOTTOM BRACKETS

Here we show you how to remove and refit bottom brackets and cranks

Shimano introduced the Octalink splined crank/bottom bracket system in 1997 with the introduction of 9-speed Dura-Ace. This system gradually spread to the lower Ultegra and 105 component sets, but has now been replaced by the new Hollowtech II system introduced first on the 10-speed Dura-Ace in 2003. However, there are still many older bikes around fitted with the original Octalink splined system.

The ISIS Drive concept began in 1998 when several companies started talking about how to compete with Shimano. At the 1999 Interbike show, Truvativ, Chris King, and Race Face sat down and began collaborating on a spline interface for bottom brackets and cranks. The result was the ISIS Drive standard – a common bottom bracket/crankset interface that can be freely shared within the industry.

The standard consists of two parts: one governing the interface between the crank and bottom bracket spindle, the other describing a set of standard spindle lengths. The spindle length section defines the relationship between the bottom bracket and the frame centre line for different standard spindle lengths, thus ensuring the correct position of the crankset relative to the frame centreline.

Shimano's Octalink system and the ISIS system are assembled similarly. Here we dismantle then reassemble both Shimano's Hollowtech II system and ISIS Drive cranks.

2C CRANK FITTING

Match the split section of the left-hand crank with the wide groove in the bottom axle and slide the crank into place. Fit the stopper plate with open ended part outboards of the crank, and refit the crank's two fastening bolts. Fit the crank cap using special tool TL-FC16. Tighten the two left-hand crank securing bolts with a 5mm Allen key – preferably with a torque wrench to 12-15Nm – repeat the tightening procedure until both securing bolts are correct. When refitting your pedals don't forget to use anti-seize grease on the threads.

3A CRANK REMOVAL

Some cranks (as pictured here) use a captive Allen bolt. These have an 8mm Allen bolt surrounded by what appears to be a dustcap with two pin tool holes. Unscrew the Allen bolt anti-clockwise. Initially the bolt will feel reasonably tight, and will then loosen up before needing a lot more force as the crank is pulled off the axle. Chainsets which do not have a captive bolt are removed by using a standard extractor with a small mushroom plug. Push the mushroom plug into the hollow bottom bracket axle end and then, using the extractor with the inner bolt fully retracted, carefully screw the crank extractor fully into the crank's threads. Tighten the inner bolt to push the crank off the axle – this may require some force. Remove the left crank in the same way.

- ✓ Cotterless crank extractor (if captive Allen bolts are not used)
- ✓ 8mm Allen key or cotterless crank bolt spanner depending on chainset
- ✓ Wire brush
- ✓ Anti-seize grease
- ✓ Waterproof grease

WORKSHOP WISDOM

ISIS bottom bracket spindles have a spindle designation number which is the nominal distance between the crank stops on the spindle. The crank manufacturer can tell you which spindle number is required for your configuration if you want to use cranks and bottom brackets from different sources. The threads in a bottom bracket shell are quite fine and can easily be damaged. Take care not to cross-thread them and check that you are screwing the correct cup into the correct side of the bottom bracket shell.

All cups on the left side of a bottom bracket screw-in clockwise and all cups on the RH side of a bottom bracket screw-in anti-clockwise except on Italian threaded bottom brackets where the RH cup screws in clockwise.

SHIMANO HOLLOWTECH II REMOVAL AND FITTING

1 BOTTOM BRACKET SHELL PREPARATION

If a frame has not been used before or not used with high quality cartridge bearing bottom bracket sets, or has been repainted, the threads should be tapped out with a inline tap set. Most frame builders and good shops will be able to do this for you for a charge of about £10-£15. The bottom shell should also be faced at the same time. The shell's threads should be smeared with a good quality anti-seize grease before any bearing cups are fitted.

2A CHAINSET AND BOTTOM BRACKET REMOVAL

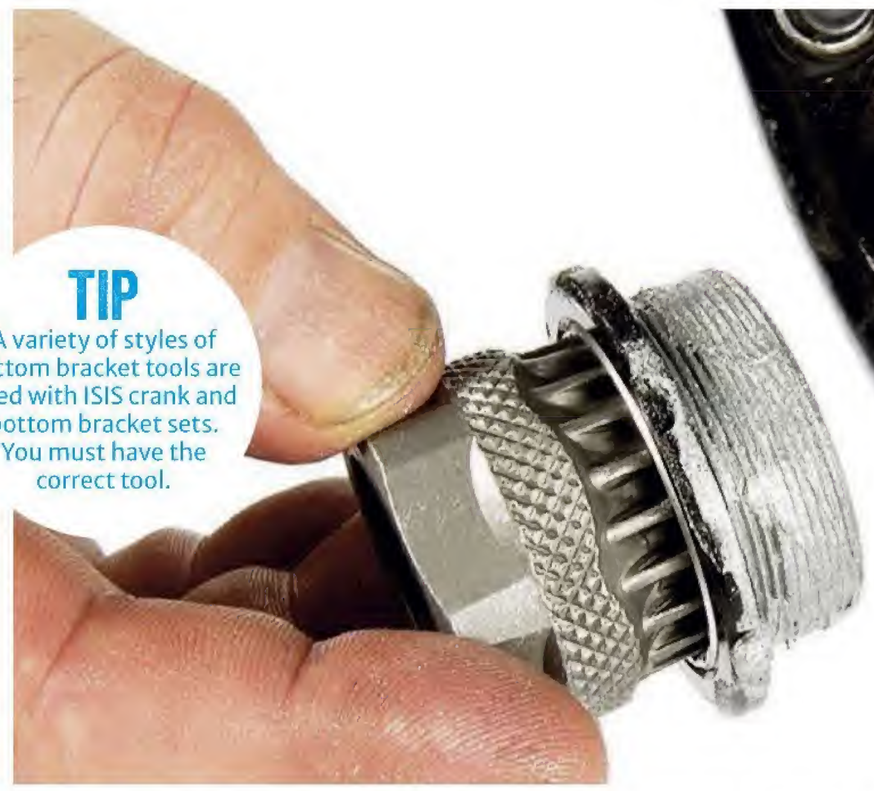
Undo and remove the plastic end cap in the end of the left-hand crank and bottom bracket with the special tool TL-FC16. Slacken and remove the two crank fastening Allen bolts and the stopper plate between the split in the crank. Pull the crank off the bottom bracket axle with your hands. With a plastic faced hammer tap the bottom bracket axle from the left side driving it and the right-hand crank out of the right side of the bicycle. Using Shimano's special TL-FC32 tool undo and remove both bearing cups. Remember that on British threaded bottom bracket shells you need to unscrew the left-hand cup anti-clockwise and the right-hand cup clockwise.

TIP

If bottom bracket bearings develop play or feel rough you will need to replace the bottom bracket bearing cups or unit complete.

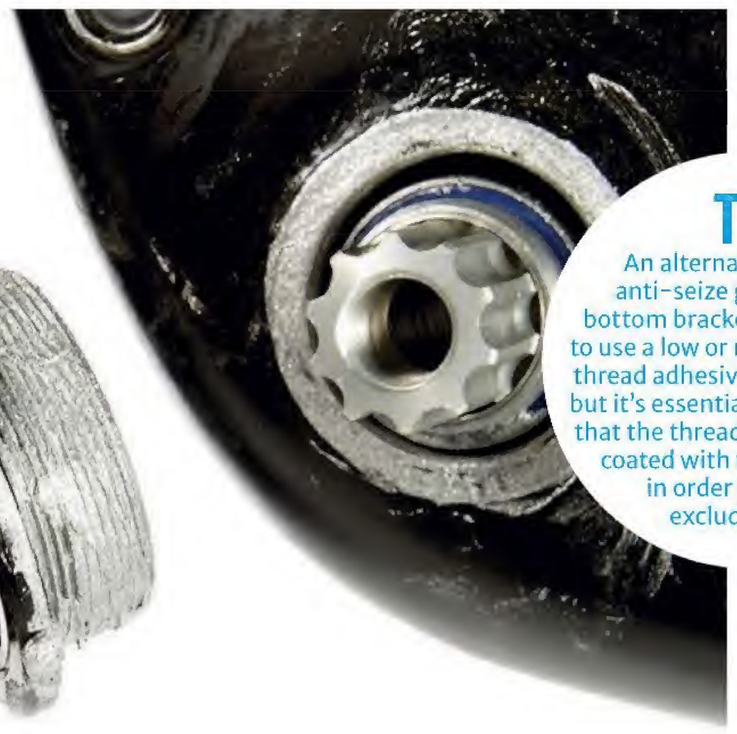
2B FITTING BOTTOM BRACKET

Smear the bottom bracket cup threads with anti-seize compound and screw the cups complete with their bearings into place using the special Shimano tool TL-FC32. With an English threaded bottom bracket shell, the left-hand cup screws in clockwise and the right-hand one anti-clockwise. Make certain to fit the correct cup to the correct side of the bottom bracket shell. And take special care not to cross thread the fine threads of the bottom bracket shell. Insert the right-hand crank complete with bottom bracket axle through the cup/bearing units.



TIP

A variety of styles of bottom bracket tools are used with ISIS crank and bottom bracket sets. You must have the correct tool.



TIP

An alternative to using anti-seize grease on the bottom bracket cup threads is to use a low or medium strength thread adhesive such as Loctite, but it's essential to make certain that the threads are completely coated with the threadlock in order to entirely exclude water.

3B BOTTOM BRACKET REMOVAL AND REFITTING

REMOVAL

Take out the spacers, if fitted, from the end of the axle. Be careful to engage the splines of the tool fully with the bottom bracket cup/unit before attempting to loosen and remove the cups. Remember, on British threaded bottom bracket shells to unscrew the left-hand cup anti-clockwise and the right-hand cup clockwise. The axle will come out with one of the cup/bearing units.

REFITTING

Reassembly of the bottom bracket is normally a matter of smearing the threads with anti-seize grease and then working backwards through the removal procedure. If a bottom bracket spindle does not rotate freely after the last cup has been tightened, back off the cup a tad and recheck. Tighten the lockring as soon as the axle rotates freely without play.

3C REFITTING THE CRANKS

Refit the spacers removed in step 6, making sure that you replace the spacers if of differing thicknesses on the correct side. Unlike square taper cranks it's recommended that the bottom bracket axle's splines should be lightly greased before the cranks are fitted. Slide the right-hand crank into place and tighten its fixing bolt, ideally using a torque wrench set to between 33Nm and 45Nm – manufacturers' recommendations vary so check this. Repeat for the left-hand crank making certain that the crank is set exactly 180° around from the right-hand one.

ROAD
OFF-ROAD

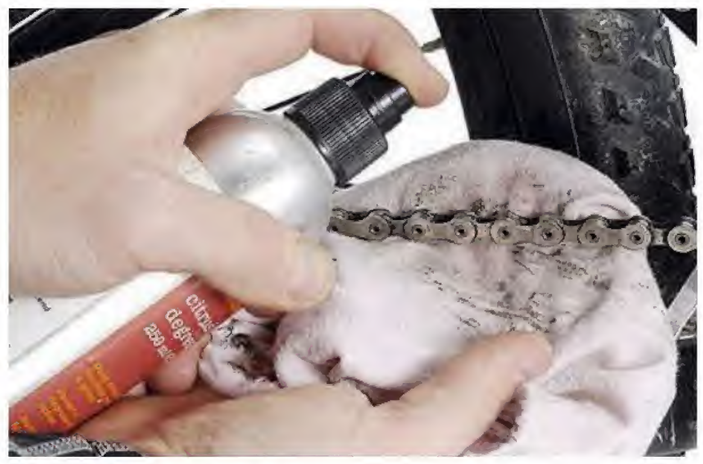
BEGINNER EXPERIENCED EXPERT

60 mins

£5 degreaser
£5 chain lube
£6 anti-seize

CHECKING DRIVETRAIN WEAR

Our 16-step guide shows you how to examine your transmission for damage and replace any worn parts



1 GET CLEANING

The first thing to do is to clean the chain and transmission. There's not much difference between almost worn and worn, and having gunge stuck in the chain links isn't going to make the precise measuring of the chain link pitch any easier. Besides all that, who wants to get covered in oil while they're working on their bike?

5 REMOVE CHAIN

Shimano chains require the use of a chain-splitting tool to break them. As the chain you're removing is worn out, you don't need to worry about being too gentle – just split the chain and let it run through the transmission. Lay it out on the floor in a straight line on a plastic bag to avoid spreading grease and getting fluff in the new chain in the next step.

6 MEASURE CHAIN

Take your new full-length chain and lay it out flat and straight next to the old one, so you can see how many links to remove to make it the correct length. You'll notice that at the halfway point, the old chain begins to show its stretch as the links no longer line up. Make sure that you take this into account before splitting the new chain.

7 FIT NEW CHAIN

SRAM chains use a splittable Powerlink system that makes fitting (and removal) a tool-less affair. Shimano chains require a special joining pin (which comes with every new chain), so insert it through the corresponding link plates and push into position with a chain tool. Snap off the lead section using pliers. If the newly joined link is a bit stiff, grasp the chain firmly each side of the stiff link and give it a slight flex. This usually frees the link.

TIP

Wear protective gloves
Oil and grease don't add to the condition of anyone's hands, so take a tip from the pro mechanics and use a pair of thin medical gloves. Park Tools makes the best ones on the market (Nitrile mechanics gloves, from www.madison.co.uk).

11 GET CLEANING

Clean the crank arm's chainring fitting tabs with a clean cloth. These get quite grubby through daily use, and any dirt left on them will interfere with the ability of the rings to be completely in line. Besides all that, it's just good bike manners to put things together cleanly. Also check the crank arm bolt holes for wear, especially on carbon arms.

12 CHAINRING ALIGNMENT

Make sure you've got the new chainrings correctly aligned. The overshift protection pin (a small pin on the outer chainring) should line up behind the right-hand crank arm. This ensures all the shifting ramps and pins are in the correct place. You might laugh at this, but we've seen it done.

13 ADD ANTI-SEIZE

To avoid the issue of having the chainring bolts seize in future, it is a good idea to protect the threads by coating them with a smear of anti-seize compound. If you haven't got any, buy some, and a dab of whatever grease you've got will do in the for the time being.

- ✓ 5mm Allen key/Torx T-30 key,
- ✓ Chain wear indicator,
- ✓ Degreaser and anti-seize,
- ✓ Chainring bolt extractor,
- ✓ Chain splitter,
- ✓ Chain whip,
- ✓ Cassette tool,
- ✓ Adjustable spanner,
- ✓ Torque wrench

WORKSHOP WISDOM

Treat yourself to a big adjustable spanner We're the first to argue the case for only using specialist bicycle tools when working on bikes, but we don't feel at all bad in recommending that every home mechanic own a large adjustable spanner. Go for a 15in length and you'll use it 50 weeks of the year.

2 MEASURE THE CHAIN WEAR

Take your chain wear indicator – we're using the Park Tools version here, but you could also try one from Rolhoff. Insert the short measuring finger on side A into a link. Allow the other end of the measure to drop between the links. On an unworn chain, the long measuring finger will not fall between its links – as in this case, you have less than 0.75mm of wear, so you're good to ride.

3 SIGNS OF WEAR

If, when you've followed the same procedure using side A of the tool, the long measuring finger falls between its links, this indicates that you've got between 0.75mm and almost 1mm of wear. You're still good to ride, but be aware that the chain is stretching so you're already adding extra wear on the soft alloy chain rings. Be prepared to replace the chain as soon as is practical to do so.

4 DOUBLE-CHECK

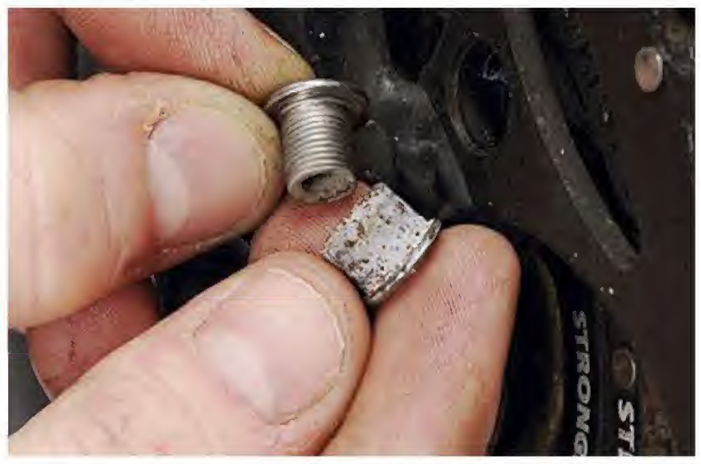
If your long measuring finger has fallen between the links, switch the tool over and measure the same set of links using the finger on the other side. If, when the small finger is in position, the long finger still falls between the links, then you've got more than 1mm of chain wear. This is a serious issue and the chain must be replaced. Failure to replace a chain that's worn to this level will damage your transmission system irreparably.

8 CHECK CHAINRINGS

Chainrings have a hard time. They're made from soft alloy to make them light, but this also means they're getting constantly mashed by the steel chain. Check your rings for hooking caused by chain stretch. Also check for bent, gouged or missing teeth – the chainrings can also wear out from non-chain-related illnesses too.

9 GET THE RIGHT BCD

Make sure your replacement chainrings share the same bolt circle diameter (often abbreviated to 'BCD' on the packaging). Also check they have the right amount of arms – it's easy to pick up the wrong one in the shop. You might want to consider making a change to harder chainrings or different gear ratios at this point.



10 REMOVE WORN CHAINRINGS

Use a 5mm Allen key (some new cranks use Torx T-30) to remove the worn chainrings. Occasionally you may find that the two threaded chainring bolt halves have corroded together. You may need to use a special tool called a Shimano TL-FC20 (Park Tools also makes a good one). This will hold the slotted side of the nut nicely and allow easy extraction.

TIP

Clean the freehub body. You'll very rarely see this hardworking component, so when you do, show it some love. You might also want to check it for wear, as sprockets can 'eat' into the splines, making them hard to fit and occasionally creak under load.

14 CHECK CASSETTE

Worn cassette clusters are easily spotted the same way as chainrings. Look for widening of the pitch between the teeth, particularly in the middle five sprockets, and any other bent, missing or otherwise damaged teeth. Remember, though, that sprocket teeth aren't uniform from new, with some lower and more twisted to provide you with faster and quieter shifts.

15 REMOVE CASSETTE

Using a chain whip, cassette removing tool and a large adjustable spanner, remove the cassette as shown. Occasionally the cassette lock ring can be stubborn to remove. Rather than applying more pressure gradually, try applying some strong sudden force to the chain whip and spanner. This can often be effective in 'shocking' the lock ring into coming free.

16 FIT CASSETTE

Line up the narrow spine on the freehub body with the narrow spline on the cassette and slide them into position. The larger sprockets will be joined together; the smaller ones will go on singly. Make sure you get them in the correct order and the right way around, and also ensure that the relevant spacers are in the right places. Replace and torque the cassette lock ring to 14Nm.

OFF-ROAD

BEGINNER

25 mins

£100 for a set of Shimano XT cranks with bottom bracket included

FIT SHIMANO EXTERNAL BB AND CRANKS

Threaded external bottom brackets are surprisingly easy to remove and refit. Here's how to service them along with their matching Shimano cranks

At first glance fitting Shimano cranks and their matching bottom bracket might seem like a job for the professional bike shop mechanic, but it's actually one you can do yourself – it's both pretty straightforward and doesn't take that long. You don't need that many tools, but do make sure your that new cranks have the right width bottom bracket for your bike's bottom bracket shell.

1 OUT WITH THE OLD

Remove the old cranks and bottom bracket from the frame, then give the bottom bracket shell a spray with degreaser and wipe it out with a rag. You should be left with bright, shiny threads with no muck, grit or water in them. If the threads are still contaminated, scrub with a toothbrush and yet more degreaser.

4 FIT EXTERNAL BEARINGS

Now fit the cups into the correct sides of the shell. Most cups have clear L and R markings to indicate which side of the frame they should be fitted into; the letters correspond to the sides of the bike as you would see them when sitting on the saddle. Use a good quality bottom bracket tool to tighten the cups – we prefer Park Tools' and Pedros' models.

5 SLOT AXLE THROUGH

With the cups installed, place the bottom bracket axle (attached to the right-hand crank, complete with chainrings) into the right-hand bottom bracket cup. To get the crank in properly you might need to give it a light tap with the flat of your hand or a soft wood or rubber mallet. It's an exact fit, so be patient. When the crank is installed into the cups you should see the left-hand axle stub protruding from the left-hand cup.

- ✓ Rag,
- ✓ 5mm Allen key,
- ✓ Grease and degreaser,
- ✓ Bottom bracket tool,
- ✓ Small brush,
- ✓ Rubber gloves (optional)

WORKSHOP WISDOM

The external bottom bracket bearings will last a long time provided the outer faces of the bottom bracket shell are correctly faced (the faces need to be exactly square). If they aren't, the bearings won't line up precisely. This might not seem like much of a problem, but it can drastically reduce the life of the bearings. We've seen it kill bottom brackets after just a few weeks of hard riding. If you have any doubts about your frame, take it to a bike shop and have the bottom bracket shell faced.

2 GREASE THE BB

With the threads clean and dry, apply a dose of grease. It's easiest to work the grease in with a small brush – you use less grease and it's more effective at getting into the right places. Our favourite grease is ProGold, which is £6ish for 2oz (www.extrauk.co.uk).

3 MEASURE BB SHELL WIDTH

Measure the width of the bottom bracket shell – it'll be either 68 or 73mm wide. The width will dictate whether you need to use any of the spacers supplied with the bottom bracket or cranks. Generally, 68mm shells need one spacer per side and 73mm shells don't need any. If you're in any doubt, re-measure the bottom bracket shell and consult the fitting instructions that came with the bottom bracket; these should tell you whether you need to use spacers.

6 PRELOAD CRANKS

The axle stub is splined to fit the inside of the left-hand crank. Slide the crank on to the axle – it should go on with ease but might require some help with a mallet. Then preload the crank by tightening the small plastic star-head screw on the arm until snug.

7 BEFORE TIGHTENING

Finally, do up the twin pinch bolts on the left-hand crank arm, giving one a half-turn with a 5mm Allen key and then the other, repeating until the arm is firmly secured. That's it, you're all ready to ride.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

90 mins

£200 for SRAM 2x10 kit inc BB

HOW TO INSTALL A DRIVETRAIN

Want to go 1x or is your drivetrain just creaking and crunching? Now's the time to either upgrade or overhaul your drivetrain. We show you how...

1 CLEAN IT UP

Give your bike a good clean, then clamp it in a workstand. Use degreaser and a rag to make sure there's no dirt or grime left on the cranks or in the BB area. Use a pair of Power Link pliers (SRAM) or a chain tool (Shimano) to remove the chain, and place it to one side. If your bike has a chain guide, slide the guides out of the way.

5 FIT THE BB

Prepare the bottom bracket shell by applying a healthy coating of grease or anti-seize all over the threads. If you're switching to a new external one, use vernier callipers to measure the shell width – it should be either 68, 73 or 100mm. There are a few between them too, but mostly on downhill bikes. You may need to fit spacers between the BB and shell – it depends on shell width, the front mech mounting and any chain device mounting.

6 SEAT THE CUPS

Carefully thread in the driveside cup anti-clockwise – the cup should easily screw in by hand. Stop at the first tight feeling and check the shell is going in straight. If you want a fit-and-forget BB, push-fit the plastic internal sleeve now.Alternatively, leave it out to simplify regreasing in the future. Repeat the cup threading for the other side, remembering that the non-driveside cup threads in clockwise. Tighten the bottom bracket into the frame.

7 FIT THE CRANKS

Apply a light coating of grease to the crank axle and carefully slide it into the bottom bracket. Wrap an old rag around the chainrings to protect your hands and firmly push the crank through the BB shell. With new and tighter bearings, a light tap with a rubber mallet can help seat the crank. Check the dust cap is still in place. Align and fit the left crank, then tighten the 8mm hex bolt to the required torque.

11 FIT CASSETTE

Clean the freehub body. If you have cartridge hubs this is a good chance to inspect the freehub itself. Use a wet lube or a lightweight grease to lube the innards, then align the master spline – the narrow one – of the freehub body to the cassette and slide together. Apply a light coating of grease to the lockring thread, and carefully tighten the lockring to the required torque rating using a torque wrench.

12 FIT OUTER AND INNER CABLES

Clip or zip-tie your pre-cut outers into place. Don't forget the cable end caps – they stop the cable outers splitting. Then slide the inners through the outers. Finger-pull them tight and bolt them to the front/rear mechs to check the shifters pull the cable, then stretch the cables by either over-shifting or grabbing an exposed section and pulling it taut.

TIP
Ensure you use the correct type (10-speed, 11-speed, etc) of Powerlink with your chain as they are not always compatible with each other.

13 THREAD THE CHAIN ON

Shift the mechs into the smallest rear cog and small ring up front. Now thread in the chain, through the front mech and back towards the cassette. Wrap it around the smallest cog and through the mech – double-check the chain runs through the cage correctly, past the built-in guides. Use a loop of old coat hanger to hold the chain together.

- ✓ BB cup tool
- ✓ 2/3/4/5/6/8 and 10mm hex wrenches
- ✓ torque wrench
- ✓ Torx key
- ✓ Chainwhip
- ✓ Cassette lock ring tool
- ✓ Rubber mallet
- ✓ Cable tension tool
- ✓ Chain tool
- ✓ Cable cutters
- ✓ Vernier callipers
- ✓ Quicklink/master link pliers
- ✓ Grease or anti-seize
- ✓ Chain lube
- ✓ Flat-head screwdriver

WORKSHOP WISDOM

10-speed won't work with 9-speed! The chain on a 10-speed transmission system is narrower than on a 9-speed one, so trying to mix and match won't result in the crisp, smooth shifts the 2x10 system was developed for.

2 TAKE IT APART

Clamp the bike in a stand. Start with pedals and the crankset: shift the chain into the big ring to protect your fingers from the sharp teeth, then remove the bottom bracket. Remember the driveside is reverse threaded, so turn it clockwise to remove, and jot down the order of any bottom bracket spacers. Then remove the front and rear mechs. Take a picture of where your shifters are to help setup, and keep the old outer cables.

3 CLEAN BB

Use a degreaser and a rag to thoroughly clean the bottom bracket shell, carefully wiping around the threads. If you're installing an external bottom bracket inspect the shell; it may need to faced, a process best done by your local bike shop. Why? If the shell faces are deformed, the bottom bracket cups and bearing won't seat fully and will be misaligned, leading to premature bottom bracket wear and failure.

4 TRIM THE CABLES

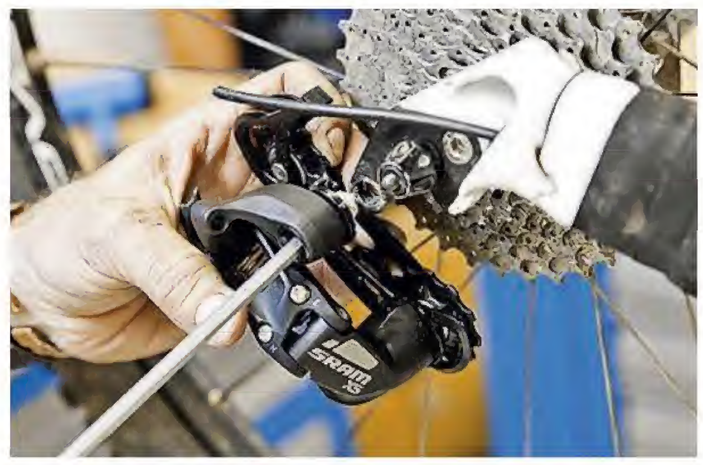
Use the old cables as guides to trim the new outers. If using full-length outers – which make quick inner cable re-lubrication all but impossible – preload the cables with either grease for wet and grimy conditions or wax/dry lube for drier conditions. To preload the outers, use an old but freshly-cut section of inner cable and a grease gun. For dry or wax lube, simply hold the cable vertical and drip the lube down into the outer.

8 ADJUST CONTROLS

Use a 4/5mm Allen key to loosen the clamps enough to allow them to move, then sit on the bike. A rough guide for brake lever position is in line with your arms; your index finger should sit in the crook of the lever bend. Try the shifters on either side of the brake levers to find the right position. Tighten the clamps so it's possible to just move them by hand, so if you crash they will rotate on the bar, rather than get smashed.

9 FIT FRONT MECH

Pull the mech cage out and set the outer cage 2mm above the outer ring. Look down on the mech and make sure the cage is in line – use the inner ring as a guide. Using either strong fingers or an old section of cable to pull the mech, set the limit screws. These control the range of mech movement. For SRAM, L = lower (towards frame) H = higher (away from frame) Once the chain is fitted, readjust both limits as necessary.



10 FIT REAR MECH

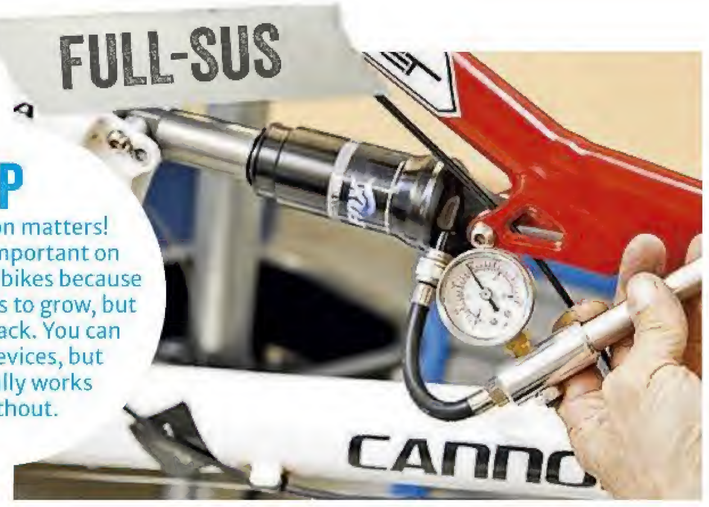
Grease the main bolt before tightening it into place. Using either fingers or an old section of cable to pull the mech, set the limit screws. As with the front, L = lower (towards spokes), H = higher (away from spokes) Again as with fitting the front mech, the limits will have to be double-checked once the chain is in place. Use the B-screw – near the main bolt – on SRAM mechs to set the upper jockey wheel/cassette gap to 6mm.

HARDTAILS

TIP

Chain tension matters! This is very important on full suspension bikes because the chain needs to grow, but not fall too slack. You can use chain devices, but 2x10 actually works well without.

FULL-SUS



14 ADJUST LENGTH

To set the chain length on big ring to big ring on 2x10s or 11s, shorten the chain until the rear mech is almost horizontal but the chain still has a double bend around the jockey wheel. Check the limit screw settings on both mechs. We don't recommend using the biggest rear cog to big front ring on triples, because it crosses the chain too much. 2x10s have a narrower chain line, which makes this possible.

15 ADJUST LENGTH

On a full suspension bike, set the chain tension with the bike fully bottomed out. To do this, first note down the shock pressure, then remove all the air (or with a coil shock remove the spring). Then set the chain length following the instructions in step 14.

16 THE FINAL SETUP

Shift into the smallest rear cog and the smallest front ring to get the lowest cable tension. Dial one and a half turns on the shifter barrel adjuster so you can slacken if necessary, tension the cable (use a third-hand tool if you have one) and tighten the bolt on the rear mech to secure it. Then slowly twist the barrel adjuster until the mech is in its lowest position. Turn the cranks, clicking through the gears. Use the barrel adjuster to tweak for silent shifting.

ROAD
OFF-ROAD

BEGINNER **EXPERIENCED** EXPERT

45 mins

£10 upwards for a new freehub

HOW TO REPLACE A SHIMANO FREEHUB BODY

All your effort pounding the pedals goes through your freehub and its tiny internals, so it's no surprise that it needs replacing regularly. Here's our guide on how to do just that

4 UNDO CONES

Now undo the disc-side cone and locknut. If there's an outer rubber Labyrinth seal, pop this off by carefully digging underneath it with a small flat-blade screwdriver. Grab two cone spanners and, with the wheel disc-side outwards, put the cone spanner in your left hand on the inner cone, and the one in your right hand at 180 degrees on the outer locknut. Using a bouncing motion, push down to undo them.

TIP

While you have the axle out, roll it on a flat work surface to make sure it isn't bent. Bent axles will cause premature wear to the bearings, cups and cones.

5 GET YOUR BEARINGS

Now unscrew the locknut and cone and remove them from the axle. Lay them and the spacers out in the order they came off for ease of correct reassembly. Withdraw the axle from the hub. Count how many bearings are in each side and write it down for when you need to replace them. Now you need to fish all of the bearings out, with a small flat-blade screwdriver and by shaking the wheel over a rag.

6 SET THE OLD FREEHUB FREE

Time to remove the offending item – the knackered freehub body. Grab your 10mm or 14mm Allen key, depending on hub type, insert the short end into the freehub body and locate it in the star socket nut inside. Unscrew it anti-clockwise. If it's stubborn you can gain more leverage either by putting a bar on the Allen key or by securing the Allen key in a vice and turning the wheel anti-clockwise.

10 REBUILD THE HUB

Apply some more grease on top of the drive-side bearings and then screw the cone, washers and lock nut back onto the hub. Make sure that the spacers go on in the same order they came off because they're an integral part of the outer Labyrinth seal.

TIP

Don't rush adjusting the cones and locknuts. Even though the final hurdle is in sight, this is the most important part of the whole procedure.

11 ADJUST BEARINGS

Here's the tricky bit – adjusting the bearings requires patience. Hold the drive-side locknut with a cone spanner, screw the disc side cone down until it's very lightly nipped up. Wind the locknut down onto the cone and lock them together by following step 4 in reverse. If you're lucky, you'll hit the sweet spot first time: no play, and free running – though there will be resistance due to the grease. If not, go to step 12.

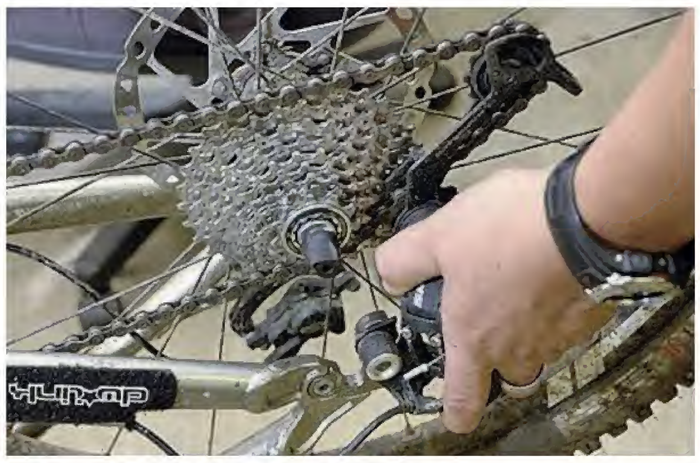
12 FINE ADJUSTMENTS

If it's too tight, place a cone spanner on the cones on both sides and twist them apart slightly. If it's too loose, put cone spanners on the locknuts on both sides and screw them together slightly. Keep testing as you're doing this until you get it spot on. Then give the cone and locknut a final tighten.

- ✓ 10mm Allen key
- ✓ 14mm Allen key
- ✓ Torque wrench
- ✓ Flat-blade screwdriver
- ✓ Chain whip
- ✓ Cassette lockring tool
- ✓ T-25 Torx Key
- ✓ Adjustable spanner

WORKSHOP WISDOM

Take your wheel with you to the bike shop to buy the parts. It's the best way to make sure you get the right ones first time.



1 GET IN POSITION

No need for a workstand with this job because we're concentrating solely on the rear wheel. So spin the bike upside down, shift it into the smallest sprocket at the back and remove the rear wheel.

2 REMOVE CASSETTE

Unscrew the skewer nut, leave the skewer in place, and put the lockring tool into the lockring. Now screw the nut back on to hold it in place. With the cassette facing outwards, place the chainwhip around the sprockets with your left hand. Put the adjustable spanner onto the lockring tool and push down with a bouncing motion to crack it undone. Remove the skewer nut and lockring and withdraw the cassette.

3 REMOVE DISC ROTOR

Some Shimano hubs need the disc rotor removing to get at the necessary gubbins for disassembly. We recommend that you remove it anyway because there is going to be grease and all sorts flying around, and you don't want that on your rotor. Grab your T-25 Torx key and remove all six bolts. If you have a Centre-Loc system, drop the lockring tool in, undo the lockring. Then wash your hands and withdraw the rotor itself.

TIP

It's very good practice to replace all the ball bearings when doing this job. They're cheap, yet pitted bearings will prematurely wear the bearing cups and cones.

7 CLEAN AND DEGREASE

Give everything a really good clean – that's the internal threads in the hub, the hollow nut, the disc-side cup where the bearings sit, the axle and the cones. Use a degreaser or aerosol brake cleaner to shift the worst of the gunk.

8 DROP IN NEW FREEHUB

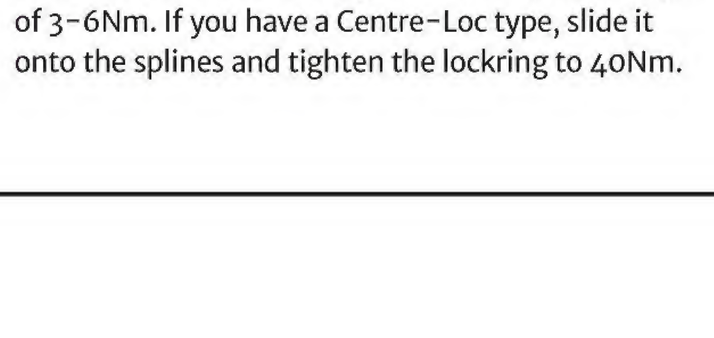
Grab your new freehub body and first hold it up against the old one to make sure it's the same dimensions – there are quite a few different types out there. Apply some threadlock onto the threads of the hollow nut and inside the hub. Drop the new freehub body onto the splines of the hub, insert the hollow nut and tighten to a torque of 45Nm.

9 GREASE YOUR BALLS

Let's get the bearings in. Smear a good, deep coating of Teflon grease in the bearing cups then lay the correct number of bearings (you counted them, remember) into the freehub body side first, then put more grease on top. Check the cone and locknut are tight on the axle and then drop it into place. Spin the wheel over, holding the axle in place and drop the same number of bearings into the other side.

13 SEAL OF APPROVAL

Push the Labyrinth seal back on. A light smear of grease inside it is a good idea. Then add another smear onto the freehub body, slide the cassette on and tighten the locknut to a torque of 45Nm.



14 REPOSITION ROTOR

Now wash your hands before putting the disc rotor back on to avoid getting grease on it. Make sure you've got the orientation right (generally the spans should be canted forward). Put some threadlock onto all of the bolts and tighten them up to a torque of 3-6Nm. If you have a Centre-Loc type, slide it onto the splines and tighten the lockring to 40Nm.

15 CHECK INDEXING

Drop the wheel back in the bike. Run through the gears to make sure they are still indexing correctly. If the new freehub body is slightly different in profile it will throw the gears out of whack. Spin the bike upright, give yourself a pat on the back and go out for a ride just to make certain everything is working properly.

OFF-ROAD

BEGINNER

30 mins

£20-£50 for narrow/ wide chainring

CONVERT 2X TO 1X

Simplify your shifting, declutter your bar and lighten your bike by switching to a single chainring

1 BREAK THE CHAIN

Clamp the bike in a workstand, then split the chain. If it's a SRAM or KMC chain, use a set of master link (or needle-nose) pliers to remove the master link, by squeezing the ends together. If it's a Shimano chain, use a chain tool to push one of the joining pins most of the way through, by aligning the tool's pin pusher with the pin and then turning the handle clockwise firmly.

5 REMOVE THE CRANKS

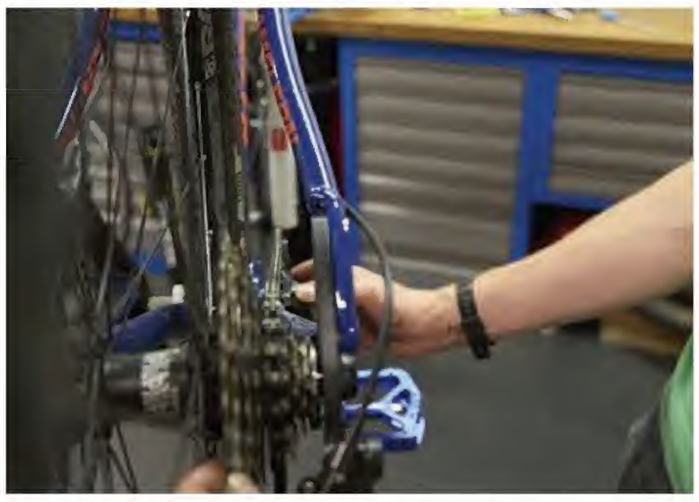
Now to remove the cranks. If you've got non-Shimano cranks, follow the manufacturer's instructions on how to do this and skip to step 7. If you've got Shimano cranks (as shown here), first loosen the twin pinch bolts on the non-driveside arm, turning them anticlockwise – alternately, and a little at a time – with a 5mm Allen key. Three revolutions is plenty.

6 TAP OUT THE SPINDLE

Use a pick (or thin Allen key) to flick up the plastic tab between the pinch bolts. Insert a Hollowtech II preload tool into the plastic preload cap and turn it anticlockwise by hand until the cap is removed. Put it somewhere safe. Tap the crank spindle through the BB with a rubber mallet, then pull the driveside crank arm to remove the crankset from the frame.

7 REMOVE CHAINRINGS

Unscrew the bolts holding the chainrings to the crank spider, turning them anticlockwise with the correct tool (5mm Allen or T25 Torx key). Store them somewhere safe, along with the chainrings.



11 CHECK THE CHAINLINE

Shift into the middle gear (fifth sprocket on a nine or 10-speed cassette, sixth on an 11-speed). Hook the chain over the chainring, look down its length and check that it's running roughly straight. If it's running diagonally you'll need to use washers to space the chainring further from the BB. Once the chain line is sorted, it's time to reinstall the non-driveside crank arm.

12 REFIT NON-DRIVESIDE

With the driveside arm hanging at 6 o'clock push the non-drive arm onto the splined end of the crank spindle at 12 o'clock. Insert the preload cap and turn it clockwise with the preload tool until gently snug. Turn the pinch bolts clockwise (alternately, a little at a time) with a 5mm Allen key, then nip them up with a torque wrench to 12-14Nm. Push the plastic tab back down.

13 DEFLATE YOUR SHOCK

If you've got a hardtail, skip this step. On a full-susser, you now need to compress the rear shock. Remove the bike from the workstand and attach a shock pump to the shock. Make a note of the pressure, then use the pump's bleed valve to remove all the air. Remove the pump and compress the rear suspension. Complete steps 14 to 16, then re-inflate to the original pressure.

- ✓ Torque wrench
- ✓ Rubber mallet
- ✓ Cable cutters – only needed for internally routed frames
- ✓ Master link pliers (or needle-nose pliers)
- ✓ Allen key set
- ✓ Torx key set
- ✓ Hollowtech II preload cap tool – only needed for Shimano cranks
- ✓ Chain tool
- ✓ Pick (can use a thin Allen key instead)
- ✓ Chainring bolt tool
- ✓ Shock pump – only needed for full-suspension bikes

WORKSHOP WISDOM

We've shown you how to install the simplest form of 1x transmission, using just a narrow/ wide chainring. The effectiveness of these new rings and the latest clutch-equipped rear mechs means chain guides are no longer necessary for many riders, but for DH or enduro use we'd still recommend using one for extra security. If you do decide to fit a chain guide, follow the instructions carefully. Set the angle of the upper guide so that the chain is just clear of the bottom of the guide when in the smallest sprocket. Then, check that the chain doesn't catch on the top of the guide when in the biggest sprocket and at full bottom-out.

2 REMOVE FRONT SHIFTER

Click the front shifter into the easiest gear, then remove it. If it has a hinged or two-piece bar clamp, turn the bolt(s) anticlockwise with the correct size Allen/Torx key until you can pull it open. If it has a fixed bar clamp, remove the adjacent grip (turn any lock-on bolts anticlockwise), undo the clamp bolts (anticlockwise) and slide the shifter off the bar.

3 REMOVE FRONT MECH

Next, remove the front mech. If it has a band clamp (as shown here), turn the single bolt fully anticlockwise with the correct tool, taking care to retain any washers. The clamp should then hinge outwards to release the mech. If it's a direct-mount mech, turn the fastening bolts fully anticlockwise, store them and any washers safely, and remove the mech.

4 REMOVE GEAR CABLE

If the front gear cable is externally routed, pull the ferrules from the ends of each section of outer, detach any zipties or cable fasteners, then remove the cable, shifter and mech. If the cable is internally routed, use cable cutters to cut the inner cable where it enters the mech, then pull the inner and outer cables from the shifter end until they're out of the frame.

8 CHAINRING TROUBLE

If the female (rear) part of a bolt spins inside the crank spider you'll need to use a chainring bolt tool to hold it still. Slot this into the groove on the back of the bolt while turning the front of the bolt anticlockwise. Align your new narrow/wide chainring with the frame side of the crank spider, with the side with the chamfered bolt holes facing the frame.

9 FIT YOUR NEW CHAINRING

Many single rings have to be attached with shorter, 1x-specific bolts, though some have spacers so you can use standard bolts. Push the female part of each bolt through the chainring and crank spider from the frame side, then thread the male part in from the outside. Don't use threadlock. Turn the bolts clockwise to the recommended torque setting.

10 REFIT THE DRIVESIDE

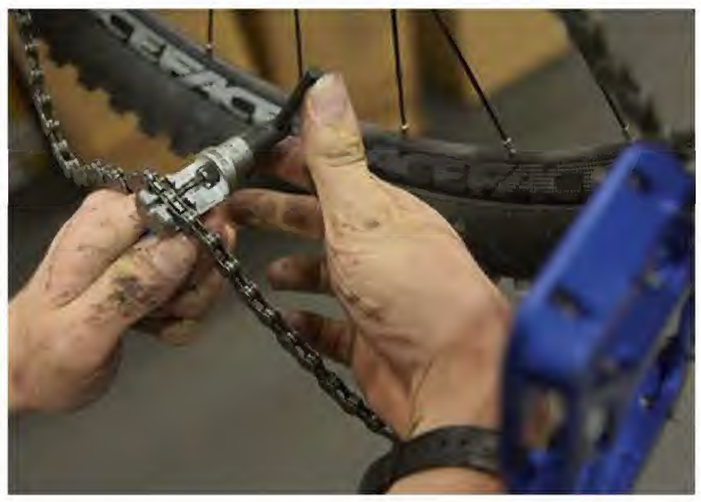
After taking the opportunity to inspect and, if necessary, clean and regrease the BB, push the driveside crank arm and spindle back into the frame. Make sure the crank spider sits flush against the BB. Don't reinstall the non-driveside crank arm just yet because you need to check the chain line.

14 CHECK THE CHAIN LENGTH

Now you're ready to check if the chain needs shortening. Shift into the easiest gear and thread the chain over the largest sprocket and the chainring. Pull the two ends of the chain together and overlap them as far as the rear mech will allow. Locate the link that would just stretch to meet the other end of the chain.

15 JOIN WITH A MASTER LINK

If using a master link, add a half link, making sure the shortened chain will have two narrow ends, then use a chain tool to split it (see step 1). Discard the unwanted links. Insert a master link plate into each end of the chain. Locate the pins in the slots, then pull both ends of the chain away from the master link to connect it. Put pressure on the cranks to tension the chain.



16 JOIN WITH A PIN

If not using a master link, add a full link (a narrow section and wide section), making sure the shortened chain will have a narrow end and a wide end (with the pin from step 1 attached), then use a chain tool to split it. Discard the unwanted links. Turn the chain tool around and push the pin from step 1 through both ends of the chain. Stop when it's flush with the opposite plate.

18+

WHAT IS AVAXHOME?

AVAXHOME-

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ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

60 mins

Approx £13 for singlespeed kit

CONVERTING TO SINGLESPEED

Converting to a single gear set-up is a great way to reduce maintenance, concentrate on your riding skills and build up your strength and leg speed over winter

1 WHIP OUT THE WHEEL

As with most workshop tasks, ideally you should put the bike into your workstand. If you don't have one then you can get away with the old favourite upside-down bike technique, but be prepared to do some scrabbling round on your knees. So first up, spin it over and remove the rear wheel.

5A SHIMANO/FSA CRANKS

Remove – and refit – the right-hand crank. For Shimano Hollowtech or FSA Mega-Exo cranks, undo both 5mm Allen bolts in the left-hand crank, remove the retainer using the correct Shimano tool or an Allen key on a Mega-Exo, remove the left crank and draw the right crank out complete with axle out. To refit, push the crank and axle through, re-mount the left crank, tighten the cap to 0.5Nm and the pinch bolts to 13Nm.

5B OCTALINK/ISIS CRANKS

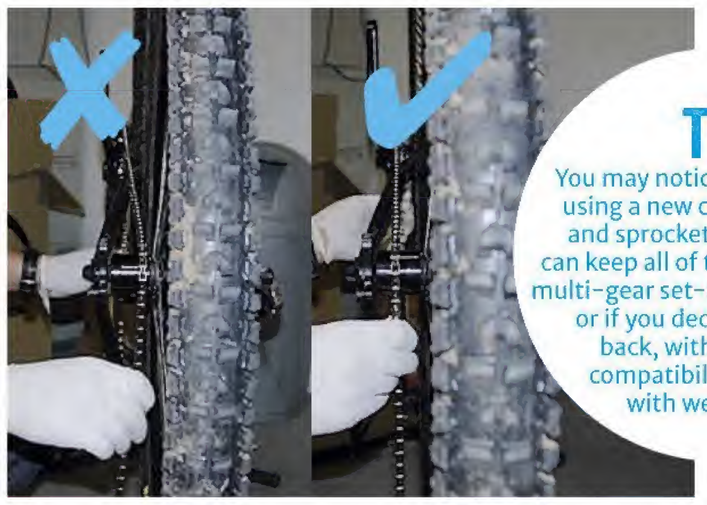
Remove – and refit – Shimano Octalink/square taper or ISIS right-hand crank by undoing the 8mm bolt. Some systems have single key release, and the crank will come off as you remove the bolt. If not, screw in the relevant crank extractor tool (ask your bike shop if unsure) and whip the crank off. Refit the crank by sliding the crank onto the splines and screwing the bolt in to a torque of 42Nm.

5C X-TYPE CRANKS

Remove – and refit – Race Face X-Type cranks by unscrewing the 8mm self-extracting bolt in the drive-side crank arm all the way before removing the crank. To refit, align the crank and screw the bolt in until it bottoms out into its stop position. This is a hard stop, and you'll be able to feel when it reaches it.

9 SPACE OUT YOUR SPROCKET

Grab the back wheel and give the freehub body a clean, including the internal threads where the lockring fits. Smear a light coating of Teflon grease over the body. Now fit the spacers and sprocket from your conversion kit, start with the thickest first, then the sprocket, then the thinner two. Thread the lockring in hand tight.

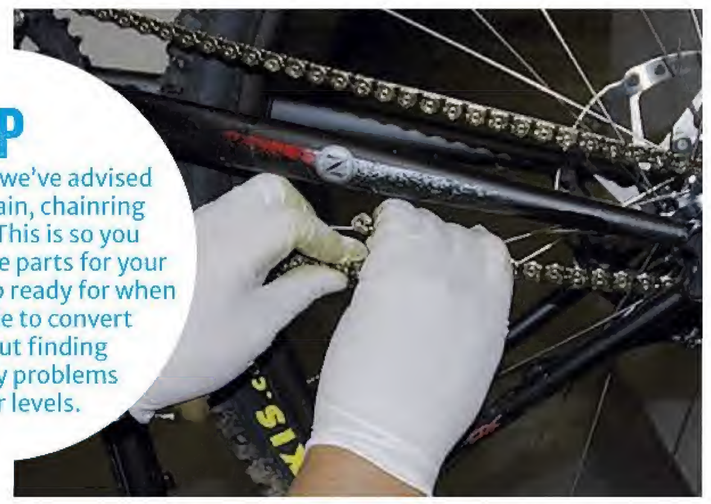


TIP

You may notice we've advised using a new chain, chainring and sprocket. This is so you can keep all of the parts for your multi-gear set-up ready for when or if you decide to convert back, without finding compatibility problems with wear levels.

10 LINE UP THE CHAIN

Put the wheel into the bike and get your new chain. Lie the chain across the sprocket and chainring, and look down it from behind. The sprocket and chainring need to be as in-line as possible, and the chain will help you gauge this. If it doesn't look right, swap the spacers around until you get it as close as possible. Once this is achieved, tighten the cassette lockring to 40Nm with your torque wrench.



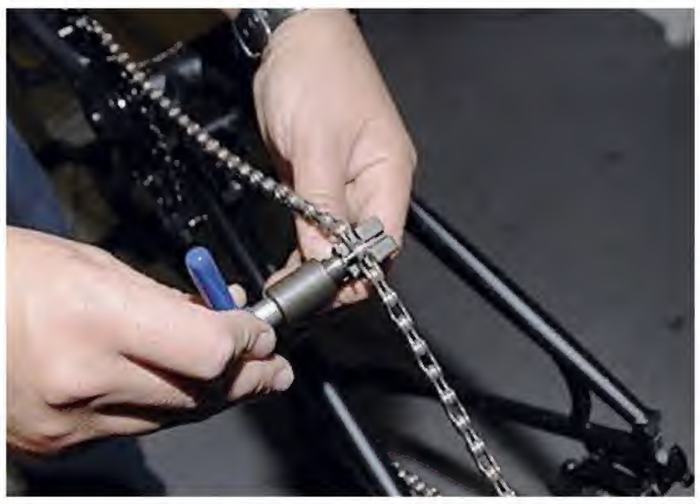
11 SHORTEN CHAIN AND FIT

You want the chain to be as short as possible. Fit the chain around the chainring and sprocket, then bring the two ends together. Work out how many links you can remove, remembering that the chain must have an outer plate-end one end and inner plate-end the other to rejoin it. Use your chain rivet tool to rejoin the chain, ensuring the join isn't stiff.

- ✓ Relevant crank extraction tools
- ✓ Chainring nut tool
- ✓ 5mm Allen key
- ✓ Chainlink extractor
- ✓ Cassette lockring tool
- ✓ Adjustable spanner
- ✓ Torque wrench
- ✓ Chainwhip
- ✓ Pedal spanner

WORKSHOP WISDOM

If you have a full-sus bike you'll need a sprung chain tensioner, such as DMR's Tension Seeker 2, because the chainstay length doesn't remain constant as the suspension compresses, and a sprung tensioner will accommodate this.

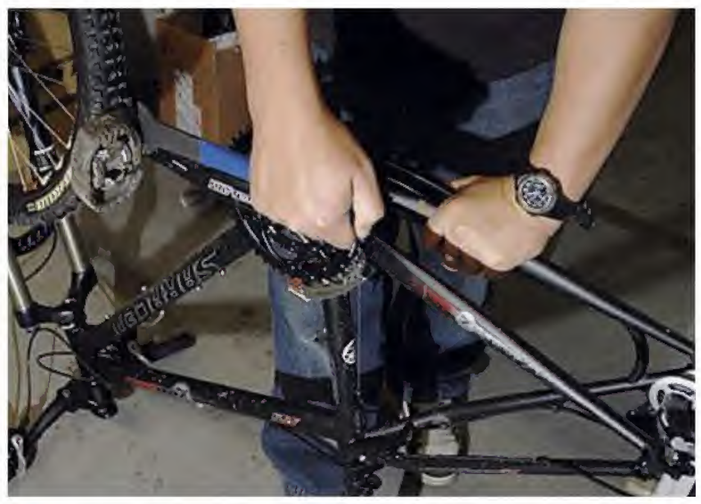


2 REMOVE CHAIN

Grab your chainlink tool and remove the chain. If you have a Shimano chain, then push the pin all the way through any others and make sure the pin doesn't get pushed all the way out. If you have a snap link, then just pull it apart.

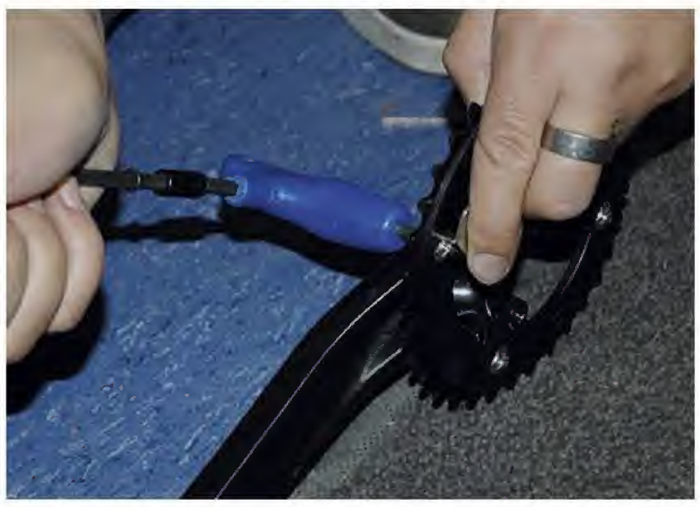
3 SET THE CASSETTE ASIDE

The cassette is the next to go. It can be pretty difficult to get the lockring cracked open, but good technique can make life easier. Check out our top tip guide for safely removing (and servicing, for that matter) particularly stubborn cassettes without hurting yourself on p32 of this very magazine.



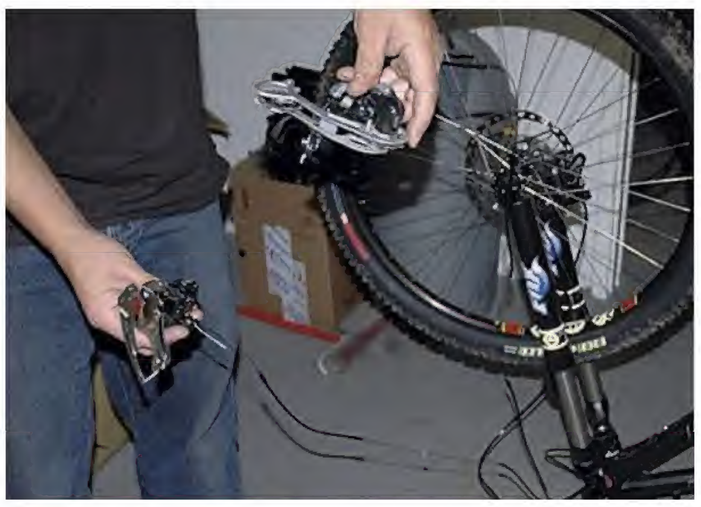
4 PEDAL OFF

Now remove the right-hand pedal from the crank. With the bike upside down, put your foot on the saddle and, with the crank in the forward position and the spanner or Allen key facing back, pull up. This gives much more power than pushing down, and is safer. Once released, fully unscrew the pedal.



6 FIT SINGLE CHAINRING

Some Shimano chainsets need a special tool to hold the nut part on the inside of the outer two chainrings. If not, use the relevant Allen or Torx keys to remove the nuts and bolts. Once off, remove the inner chainring by removing the bolts. Now fit your new chainring into the middle position and bolt it using your single chainring bolt set. Tighten it to 9.5Nm for steel, 7.5Nm for aluminium. Refit the crank to the bike.



7 SHIFT THOSE SHIFTERS

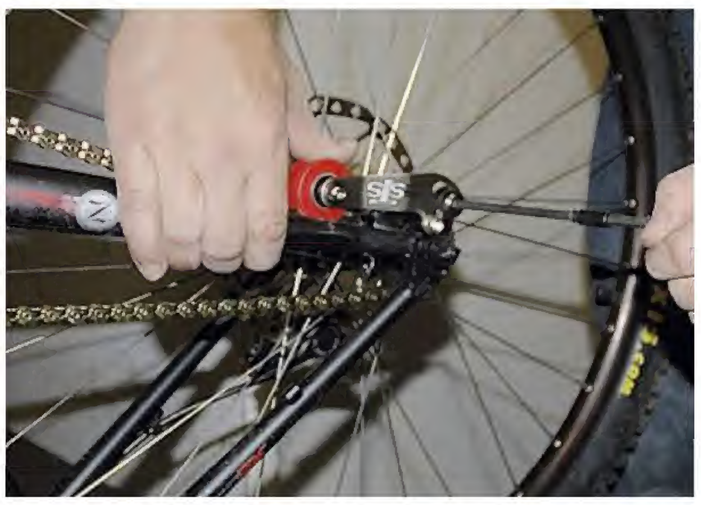
Time to remove the now redundant derailleurs. If you have top-tube routed cables, you can leave them attached to the shifters. This helps if or when you decide to convert back. Unhook the cable outers from the slotted guides. Undo the rear mech from the dropout and remove the front mech from the frame. Thread them through the frame or brake hoses towards the shifters.

8 GET A GRIP

Hopefully you've got lock-on grips, otherwise you're now going to need new ones. Remove the grips from the bars. If your shifters are outboard of your brake levers, remove them. If not, measure the distance of the brake levers' clamps from the end of the bars. Remove the brake levers and shifters, and replace the brake levers in their pre-measured position. Slap the lock-on grips back on, or a new pair if needed.

12 MOUNT CHAIN DEVICE

We've used a DMR Simple Tension Seeker here, because we've found it to be the most universally compatible. Attach the figure-of-eight adapter to the dropout by sliding it onto the quick-release and then locking it down against the frame. Then bolt the tensioner arm onto the adapter and dropout using the bolts in the kit. Leave it loose for now. For other systems, follow their enclosed instructions.



13 ADJUST TENSION

Push the arm and roller up against the chain so the chain is under mild tension. If you apply too much pressure to the chain it'll be noisy and inefficient, too little and you risk the chain falling off. About 5mm of free play up and down in the centre between chainring and sprocket is about right. Lock it down into place, tightening the bolt into the gear hanger to 9Nm, and the bolt into the adapter to 8Nm.

14 GEAR UP FOR ONE GEAR

Spin the bike the right way up, screw your pedal in to the crank and tighten it to a torque of 35Nm. Get your brake levers adjusted to your preference, tightening them to 5Nm. Now hop on the bike and go for a quick spin around the block to make sure everything is working 100 %. Welcome to the world of simple, low maintenance singlespeed cycling.

SETTING UP SPD PEDALS & CLEATS

Installing your SPD pedals and cleats properly will maximise your pedalling efficiency and help you prevent knee injury

1 BEFORE YOU START

Shimano pedals are marked with a left and right indicator on the body of the axle of the pedal. When installing the pedal, it's easy to get confused which way tightens and which way loosens. Just remember that with your bike upright, turning the pedal in the direction of the pedal stroke tightens it, and turning it in the opposite direction of your pedal stroke loosens it.

5 MARK POSITION OF A WORN-OUT CLEAT

If you're replacing a worn cleat that's already in the right position, draw the outline first with a permanent marker so you can fit your new cleat in the same spot. SPD cleats leave an indentation behind on shoes with a plastic mount, which you can use to line up your new cleats. Use a 4mm Allen key to remove the bolts.

6 LOOSEN THE BOLT HEADS

If the bolt heads are encrusted with mud, use the smallest Allen key you can find or you'll risk rounding them out – which will mean you'll have to drill them out to remove them. If the mud is proving particularly stubborn, soak the cleats in some water overnight to soften it up.

7 ANTI-SEIZE

Apply some anti-seize to the new bolts – such as copper slip – which helps to reduce mud and water ingress better than ordinary grease. Tighten up the bolts slowly and evenly, so that the cleat doesn't shift around.

TIP
Higher cadence riders will want the cleat a little forward, while those who ride bigger gears will probably want them a little further back.

11 RECHECK THE CLEAT POSITION

With your shoes back on, balance yourself against a wall and clip in. Your legs should hang naturally down, without any noticeable stress on your joints. Check how much float there is to either side – the amount of lateral movement before the cleat disengages – to ensure it's even. If there's any discomfort, adjust the cleat until it feels better.

12 ANY RUBBING?

Backpedal and make sure your heel doesn't rub against the cranks when your shoe is floated in its most inward position. If there's any rubbing, move the whole cleat parallel to the left, being careful not to alter its angle.

13 TAKE A TEST DRIVE

Take your bike outside and go for a leisurely spin. Try to feel whether there is any twisting through your joints, particularly the knee. As you spin, there should be no sense of awkwardness or pressure anywhere. When you're happy with the position, run a permanent marker around the cleat, so you'll know where to position it next time it wears out if it doesn't leave an indentation.

- ✓ Pedal spanner or 6/8mm Allen key depending on your pedal,
- ✓ 3mm and 4mm Allen keys,
- ✓ Grease anti-seize,
- ✓ Pen or marker,
- ✓ Sharp knife if shoe tread needs customising

WORKSHOP WISDOM

If you're getting prolonged aches and pains then visit a bike fit specialist like Cyclefit (www.cyclefit.co.uk), as you may need custom wedges in your shoes to even out the pressure.

2 REMOVE PEDALS

If your pedals are hard to remove, use a pedal wrench to increase the leverage – or the longest length Allen key you can find that fits (typically a 6mm or an 8mm) – rather than a stubby multi-tool. Be sure to check the Allen key has fully engaged, so it doesn't slip and round out, or gouge your hand on a whole chainset worth of teeth.

3 CLEAN THE CRANK ARM THREADS

Before fitting your new pedals, clean and check the threads on your crank arms. Lightly apply some grease to the threads on the pedal to help remove them next time. Applying it to the pedals will spread the grease across the threads.

TIP

If your pedals come with washers, don't forget to use them as they'll protect your crank threads getting stripped. Fit them with the rounded side towards the cranks.

4 TIGHTEN THE PEDAL

Start by tightening the pedal carefully by hand, making sure the pedal is parallel to the crank to avoid any cross-threading. Use a pedal wrench to tighten up the pedals snug and tight, or a 6mm or 8mm Allen key if there are no wrench flats. Shimano pedals use bearings, so will self-tighten as you pedal. Take care with ultra-light pedals because some use bushes, and can loosen off as you ride unless done up sufficiently tight.

TIP

If you're having trouble engaging the pedal, check the lugs on your shoes aren't getting in the way. You may need to cut back some of the rubber around the cleat with a Stanley knife for added clearance. Pedals from other manufacturers use thin plates to alter the height of the cleats, but most shoes tend to be fine with Shimano ones.

8 CLEAT POSITION

If you're fitting cleats to a new set of shoes, you'll need to spend some time finding the optimal place in which to position them. With your riding shoes on, but without any cleats fitted, sit on your bike and hang your right foot down in a natural pedalling position. Mark a spot on the outside of the shoe to show where the cleat sits in the fore and aft relation to the axle. Roughly speaking, the cleat should sit under the ball of the foot.

9 CHECK YOUR FEET

Sit up on a table with your legs dangling down and your shoes and socks off. Take a good look at your feet – do your toes naturally point in or out? If they do, draw a line on the underside of the shoe, aiming to mimic the angle of your feet. This gives you a rough guide to the lateral position of the cleat. Although there's some float in the pedal, finding the right angle will remove undue stress on the knee joint.

10 ATTACH CLEAT

Line up your markers so you can position the cleat in both directions, both fore and aft in relation to the axle and its angle in relation to your shoe. Nip down the bolts just enough to keep them firmly in place. Try not to let them dig into the sole of the shoe, because the indentations left will make fine-tuning harder – carbon soles are more resistant. Don't use any grease just yet.

14 APPLY MORE ANTI-SEIZE

Remove the bolt and apply a couple of dabs of anti-seize on the bolt threads – this will be more effective than ordinary grease in keeping mud and muck at bay. Don't overlook this step or you risk the bolts seizing over time, and rounding out when you try and remove them. If this happens, you'll need to drill them out.

15 TIGHTEN CLEATS

Tighten down the bolts of the cleats evenly, making sure they don't shift in position. Ensure the 4mm Allen key is properly engaged so you don't round out the bolt heads – applying some degreaser to the Allen key head will remove any grease that may cause slipping. If you're using old bolts and they're a little worn, pop in some new ones now and avoid any hassles later.

16 ADJUST SPRINGS

Adjust the four spring tensions evenly with a 3mm Allen key. If you're new to clipless pedals, keep them fairly loose until you gain confidence. Shimano's multi-release silver cleats (SH56) are great for beginners; when the pedal's spring tension is tightened, they can be released by sharply pulling upwards while still being easy to disengage from side to side. Don't forget to loosen off the pedals again if you swap to normal SPD cleats.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

40 mins

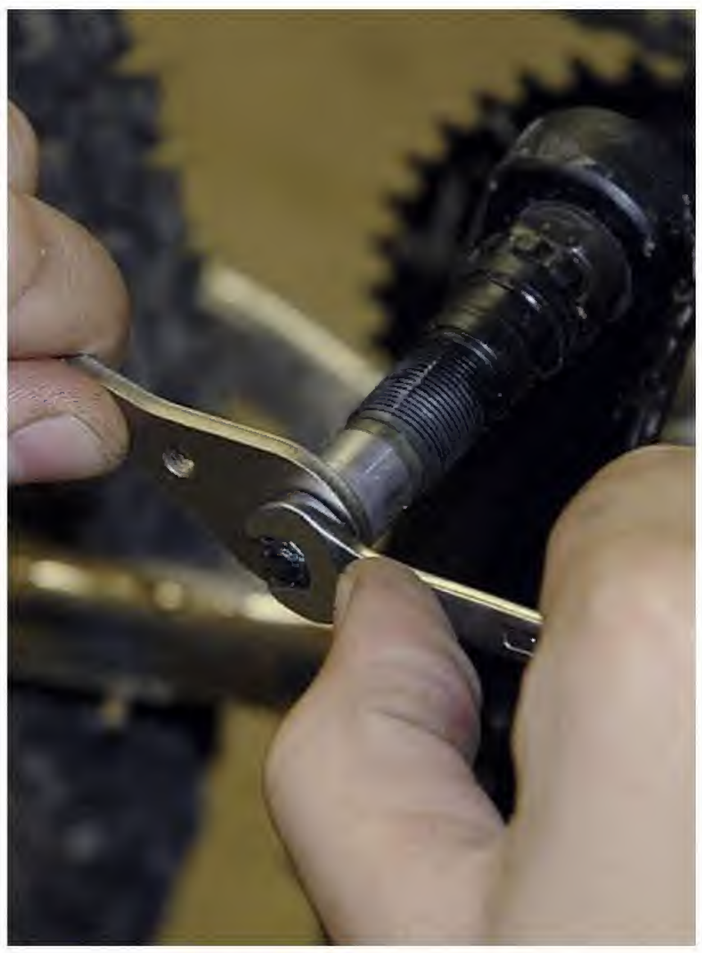
Free

STRIPPING SHIMANO SPDS

Shimano SPD pedals are pretty robust and will spin for miles, but if they do start to run rough it's easy to give them a service. Here's how in 10 simple steps

1 REMOVE PEDALS

First up we need to get the offending items off the bike. Spin the bike upside down and grab your pedal spanner or long 8mm Allen key. Put your foot on the saddle and with the crank facing forward and the spanner or Allen key facing backwards, pull up to release the pedal. This is the same for both sides, because the left-hand pedal has a left-hand thread.



5 LUBE SPRINGS

Shimano's spring mechanisms are super hardy and don't really need any maintenance, but a bit of TLC never goes amiss. Get a thick lube dropper bottle, such as Muc-Off Slick Caramel, and drop a little oil over the springs and into their pivot points.

6 TIGHTEN BEARINGS

Adjust the bearings if required. Thread the axle assembly into the crank and lightly nip it up. Ideally you need a Shimano TL-PD-73, but you can get away with thin 10mm and 7mm spanners. Hold the 10mm nut still and undo the 7mm nut. Tighten the 10mm nut a fraction at a time then tighten the 7mm nut back onto it. Grab the metal barrel and check it spins freely and without play. Continue until the play has been adjusted out.

7 PURGE THE DIRT

Now for the simplest but most important step: purging dirt and contaminated grease from the bearings. Get a decent quality Teflon grease and half fill the pedal body with the grease. When you refit the axles this grease will be forced up through the bearing and will push out all the dirt before it.

- ✓ 17mm spanner (for XT/XTR)
- ✓ 20mm spanner (for DX SPD)
- ✓ Shimano bearing adjustment tool TL-PD-73 (optional)
- ✓ Long 8mm Allen key
- (for XT/XTR)
- ✓ Pedal spanner
- ✓ Shimano pedal axle tool TL-PD-40
- ✓ Thin 10mm and 7mm spanner
- ✓ Adjustable spanner
- ✓ Degreaser or brake cleaner,
- ✓ Loctite Threadloc 242,
- ✓ Torque wrench,
- ✓ Cross-blade screwdriver

WORKSHOP WISDOM

You can make servicing the bearing take a matter of minutes by adding a grease port to the pedal (not for DX). Drill a 2.5mm hole in the end cap, or in the very centre of the pedal body. You can now use a needle nose grease gun to grease the bearings and purge out the old contaminated grease. The grease will act as a seal to keep any dirt and water from entering the pedal.

2 EXTRACT AXLE

Now remove the axle. Use a 17mm spanner for XT and XTR, 20mm for DX and Shimano's TL-PD-40 tool for the rest. Put the pedal in a vice with soft jaws or in a workstand clamp. As a last resort, hold it in the jaws of an adjustable spanner. Use the adjustable spanner on the TL-PD-40 tool, or the relevant size spanner, to screw the collar all the way out; remember, the right-hand pedal is left-hand thread and vice versa.

3 GET CLEANING

You need to get everything clean now. Wipe as much dirty grease as possible away from the axle assembly. There will still be some that you can't get at, but we will deal with this later. Use a rag inside the pedal body to get it ship shape. Give the pedal's body a good scrub with some soapy water and a brush too. Dry it completely afterwards.

4 SECURE SCREWS

The top plate screws can come loose and cause clicking when you pedal, or fall out completely. To ensure the top plate stays in place, remove the screws one at a time with the cross-blade screwdriver (or 2.5mm Allen key for XTR) and then clean the thread. Give it a fresh coating of Loctite 242 or similar. Tighten them to 4Nm using your torque wrench. Repeat for the rest of the screws.

8 REASSEMBLE AXLE

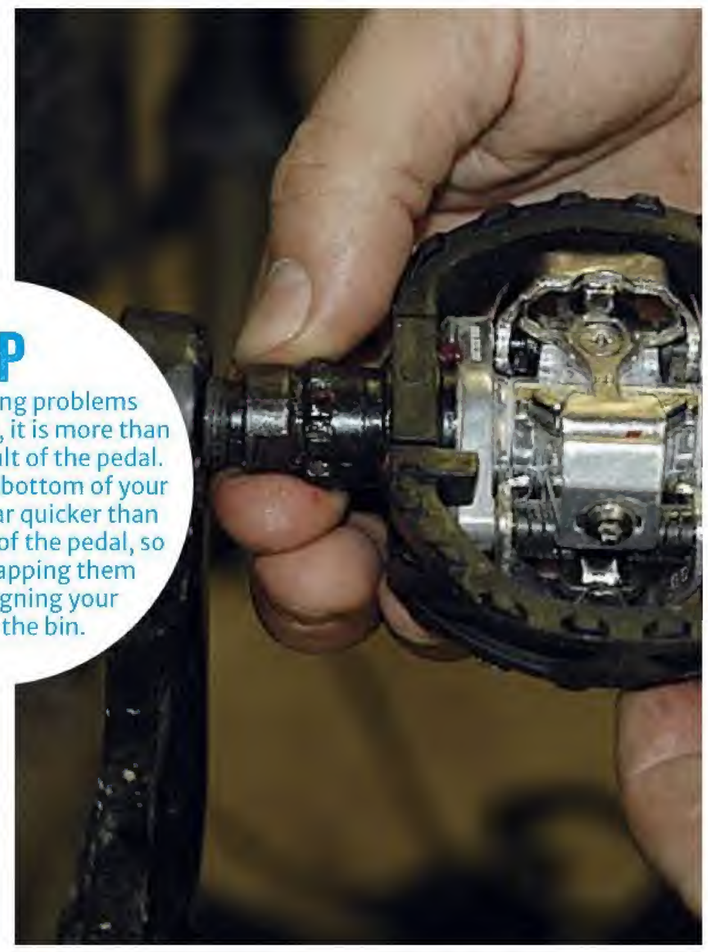
Refit the axle assembly. Make sure you get them the right way round. The collar will be marked with a 'tighten' arrow. The one that tightens clockwise (right-hand thread) goes into the left-hand pedal, and the one that tightens anti-clockwise (left-hand thread) goes into the right-hand pedal. Tighten the assembly all the way in until it comes to a stop at the end of the thread.

TIP

If you are having problems clipping in or out, it is more than likely not the fault of the pedal. The cleats in the bottom of your shoe wear out far quicker than any of the parts of the pedal, so always try swapping them before consigning your pedals to the bin.

9 GET RID OF GREASE

It's a good idea to clean the pedal before refitting. Spin the axle a few times and wipe away the grease that comes out of the seal. When you have done this put some mild degreaser or brake cleaner onto a rag and wipe over the surface of the pedal to remove any grease residue.



10 REFIT PEDALS

Refit the pedals to the bike, making sure you get them in the right way round. Thread them in very slowly to start with, using only your fingers, as it is easy to cross-thread them. Once you have each pedal threaded in at least halfway by hand, use your spanner or Allen key to tighten to a torque of 40Nm, using your torque wrench.

ROAD
OFF-ROAD

BEGINNER
EXPERIENCED
EXPERT

1-2 hrs

Free!

SERVICING DUAL-PIVOT BRAKES

The rigours of riding, particularly in the winter, are hard on your brakes. However, there are simple steps to keep them working efficiently, whatever conditions you ride in

Modern brakes are very reliable and perform sufficiently well that it's easy to think they are maintenance-free, but they do still need regular checks and, in particular, regular cleaning. Cable sets should be replaced every two to three years as the inner liner wears, and the inner cable alone should be replaced if it has become frayed. Brake pads/shoes should be replaced when the grooves have worn away or the wear line is reached. Many modern bikes' brakes have replaceable brake shoes.

Brake cable outers are made from spiral wound steel with a plastic outer covering and a polythene liner and should be cut with side cutters. Cable cutters should be used to cut inner cables. Inner cables for use with drop-bar levers have a pear shaped nipple. Universal brake inners will come fitted with both a pear-shaped nipple and a barrel-shaped one; simply cut off the barrel nipple.

There are three types of internally-run cables

1 Where there's a small diameter tube for the inner wire to run inside the frame and the outer casing stops at the tube. The inner wire is simply fed through the small diameter inner tube and the outer casing cut to protect the exposed wire.

2 The outer cable runs right through the frame. Remove the outer cable first from the frame, leaving the inner cable still in place. Slide the new outer over the old inner and feed through the frame until it comes out the other end. The inner can then be replaced.

3 The inner wire runs bare through the frame with the outer casing simply stopping on the outside of the tube. Remove the outer from the brake end and slide a long piece of the thin liner from the outer casing over the old inner wire right through the frame before pulling the inner cable out. Slide the new inner wire through the new outer and extra piece of liner. Remove the extra piece of liner once the new inner wire is fully in place.

4 CABLE FITTING 1

Undo the inner cable at the calliper. Undo the top half of the handlebar tape. Remove the old brake cable, push the inner cable out through the brake lever. Slide the new inner cable through the brake lever body. Sometimes it may be necessary to remove the lever body from the bar before threading the inner cable through. Slide the first section of the outer cable over the inner cable and make certain that the cable with its ferrule fits tight up to the lever body. Tape the outer cable to the bars along the grooves if possible or along the front of the bar.

5 CABLE FITTING 2

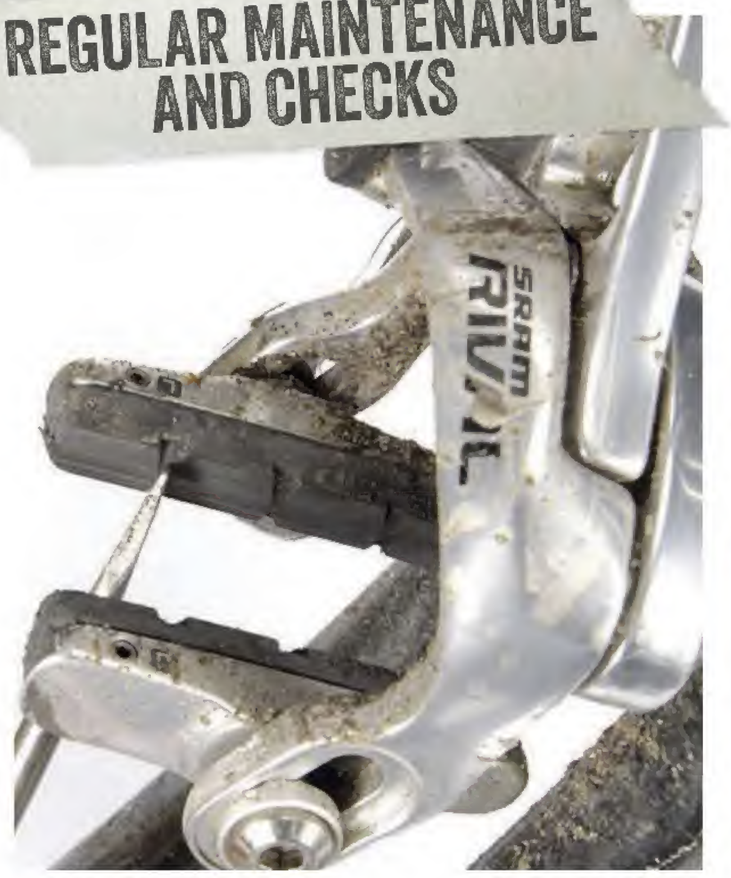
Retape the bars. Feed the outer cable through the stops or guides. Ensure the quick-release is closed (with Shimano and SRAM these are on the calliper, Campagnolo's is on the lever). Thread the inner cable through the cable-clamp and fasten approximately into place. Turn the brake cable adjuster about one turn anti-clockwise. Trim off the inner cable, leaving about 5cm beyond the clamp bolt. Slide a cable end cap over its end, hold in place and with side cutters gently crimp the cap three times. Don't squeeze the side cutters too hard because it's easy to slice through the cap.

6 BRAKE ADJUSTMENT

Hold the brake blocks on the rims, pull the cable taut and tighten the clamp bolt. Pull hard on the brake several times. Check that the clearance between the brake pads and rim is about 2-3mm. If it is just a little more or less, use the cable adjuster to get it right. If it is a lot more, start from the beginning again by loosening the inner cable and pulling taut with the brake pads held against the rim. If just one brake pad is rubbing on the rim, you need to centre the brake calliper – see step 7.

- ✓ Cable cutters, side cutters
- ✓ 5mm Allen key
- ✓ small crosshead screwdriver (Shimano)
- ✓ 2mm Allen key (Campagnolo)
- ✓ 12mm open-ended spanner (SRAM)

REGULAR MAINTENANCE AND CHECKS



1 BRAKE PADS AND RIMS

Keeping your rims and brake pads clean is essential if your bike is used in wet weather. Wash the rims and pads with slightly soapy water to remove the dirt and grey aluminium oxide film; this will greatly improve brake efficiency. Remove embedded grit from the pads. Check the rims' surfaces are not ridged or concave. If they are, investigate further or ask an expert. Rims can fail when worn, with serious consequences. Replace the brake pads well before they wear out completely.

2 CALLIPERS, BRAKE LEVERS AND CABLES

Check the inner brake cables are not frayed either inside the brake lever or at the calliper. Check the inner cable's end cap has not fallen off; replace if needed. Apply a thin coating of anti-seize grease to the brake adjuster threads, which is a frequent point of seizure on bikes used in wet weather. Check that the calliper mounting bolts are tight, the calliper arms pivot smoothly, and both brake pads hit the rim evenly without rubbing the tyre or overlapping the edge of the rim's braking surface. Check the brake levers are secure.

CABLE REPLACEMENT

3 CABLE TRIMMING

It is important that the outer cable for the rear brake is not too short; check that the bars can be turned freely either way without tugging the outer cable. If okay, use the length of the existing cable as a guide to the length of new cable required. Use side cutters to cut between the spiral, making as clean a cut as possible. Use a small file to trim the end flat and then a small pointer to open the end of the liner. Fit the ferrule.

TIP

If you use carbon fibre rims without an aluminium braking surface, it is essential to use special brake blocks that are less abrasive and retain more braking ability in the rain.

TIP

More recent Campagnolo brake shoes use Torx headed screws and need a T-25 Torx key for fitting removal or adjustment.

7 CALLIPER CENTRING

Both brake blocks should sit an equal distance from the rim after adjustment. If one brake block rubs the rim you'll need to centre the brake calliper. It's best to use a thin open-ended spanner as shown. Where fitted, you can make micro adjustments to the grub screw on the calliper arm using an Allen key or crosshead screwdriver, grasp both calliper arms and twist the brake or loosen the calliper mounting bolt, reposition the calliper and then retighten.

8 FITTING NEW BRAKE SHOES

Undo the Allen nut/bolt securing each brake shoe and replace with the new shoe. It is vital that any open-ended shoe has the open end facing rearwards. Align the brake pads so they line up with the rim's braking surface and do not touch the tyre or overlap the rim edge. With brakes that allow angular adjustment of the shoe, fit the conical washer on the inside and the plain washer on the outside. Slide a layer of card behind the rear edge of the brake pad, push the brake pad firmly against the rim and then tighten its mounting bolt firmly. The front edge of the brake pad should touch the rim 1mm or so before the rear edge.

9 FITTING NEW BRAKE PADS TO OLD SHOES

With the brake shoes still in the calliper, remove pad-retaining screws if fitted. Loosen the shoe mounting bolt and turn the shoe if necessary so that its open end faces outwards from the calliper. Retighten the mounting bolt and insert a screwdriver between the pad and the shoe, gently levering the front edge of the pad out of the shoe. Remove the brake shoe and pull the pad completely out of the shoe. Slide the new pad into the shoe from the open end. If it's tight use a little washing-up liquid on the pad/shoe interface. Refit the shoe as described in step 8. Readjust the brakes as in step 6.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

60 mins

£0 to service, £10 pads, £15 callipers

CURING SQUEALING RIM BRAKES

Squealing brakes are annoying at the best of times. When you're out on a group ride they can be downright embarrassing. Here's how to cure them

Even pros get plagued by screeching brakes once in a while. We've all been there. The shame of it, with packed pavements stopping to stare at you and riding friends preferring to keep their distance, is enough to make you avoid using your brakes altogether. Of course, that isn't really a sustainable solution to the problem.

Help is at hand though. It's all about being methodical and running through a sequence of settings. By a patient process of adjustment, testing, and elimination, you should arrive at a positive result and enjoy silent braking again.

The following tips will hopefully explain and illustrate some of the principles involved for the three main types of brakes commonly seen. The most important principle affecting noise is the angle of the pad relative to the rim: generally, the front must come into contact before the rear – known as 'toe-in'. Correctly toed-in brakes should be beautifully squeal free.

4 SNUG AND SECURE

First tighten the main fixing bolt to ensure the calliper is firmly attached to the frame. This will be a 6mm recessed nut with a 5mm Allen head, or an older style non-recessed 10mm hex head, preferably a nylock nut (with a nylon insert to prevent the nut working loose). Using a brake spanner or cone wrench on the back adjuster nut, release the front lock nut and tighten the adjuster nut enough that the arms don't deflect under braking loads, while still moving freely and allowing snappy lever return. Re-tighten the lock nut. Some dual-pivot brakes have an exposed pivot bolt – it's usually a 4 or 5mm Allen. Tighten firmly while retaining movement.

5 SIDE PULL TOE-IN

With the advent of concave/convex washer systems, toe-in adjustment achieved by bending the calliper arms has become pretty much obsolete, but among bikes being dusted off and taken out of the shed there'll be a few skinny Weinmann side pulls getting a second chance at glory. Bend the arm inward at the front – we used a Park tool that's now discontinued, but you could use a small adjustable spanner positioned to grab the arm in a similar way. On current dual-pivot brakes – the modern ones – you'll often get a set of concave/convex washers making toe-in easy; if yours are slightly older and don't have them, install some that do. Tighten pads firmly so they can't be moved or twisted by hand.

6 BAGGY PIVOTS

Minimising flex and vibration is the main goal of this anti-noise exercise, so checking that the pivot mechanisms and bolts are tight is critical. V-brakes and cantis are attached to the frame posts using a 6mm bolt, usually Allen but occasionally with a 10mm standard head. The brake arm either rotates directly on this pivot using a brass bushing on older cantilevers, or incorporates an integrated pivot system which displaces wear from the frame post to its own internal mechanism, shared by modern Vs and cantis. This will also include a spring and adjustment screw, which add mechanical complexity and wear possibilities. Replace if the arms are really baggy, and/or if any toe-in of over about 3mm is lost through play in the arm.

- ✓ 4, 5, 6mm Allen keys
- ✓ Adjustable spanner
- ✓ Mavic abrasive block or fine sandpaper
- ✓ 10, 11, 12, 13, 14mm offset brake spanners
- ✓ 8, 9, 10mm Y-wrench
- ✓ 10mm box-end/ open-end spanner

WORKSHOP WISDOM

Brake squeal is caused by vibration, as that's a fundamental requirement of generating sound (unless you happen to be riding in a vacuum...).
Vibration between the rim and pad can be caused by many things, but is most commonly a result of the interface between the pad and the wheel rim. Sorting your brakes out using all of the steps here will make sure your brakes are as good as they're going to be, but there's no hard and fast rule that will guarantee that you still won't be getting brake squeal.
The most common remedy, and often the quickest, is to fit a new set of brakes pads to freshly cleaned rims. Dual compound pads such as Ashima's 3-function pads seen here can help to reduce the chance of the dreaded brake squeal from coming back. The grey areas of the pad are harder, and the orange areas are softer. The harder section of the pad gives slightly less friction than the orange section, but it also serves to clean up the rim every time you use your brakes.
This kind of pad gives the best of both worlds, plenty of performance when you really haul on the anchors and clean rims for smooth, squeal-free braking.

1 CLEAN-UP ACT

If your pads still have a fair bit of material, then you'll need to clean them first. Wipe them off with a bit of damp cloth and check the wear indicator, usually a line about 2mm from the backing edge, marked 'wear line'. If they're worn beyond this mark then you should replace them. The pad will sometimes have developed a ridge along either the lower edge, which indicates that it's set too low, or the upper edge, which could indicate it's too high and risks wearing through the tyre over time. Using a coarse half round file or emery cloth, roughen up the surface, making sure to remove all signs of shiny hard glaze. Remove the pad first to improve access if required.

2 RIM IN TRIM

The condition of the rim surface can have a great effect on braking and noise levels. Most rims now have a machined or heavily scored surface when new. This has gone a long way to reducing the need for masses of toe-in, but as this rough surface becomes re-polished, squealing can occur. Not only can pads get glazed, but so can rim surfaces. Removing bits and pieces of embedded aluminium will keep the scraping noise down; you might have noticed little raised dots of metal which form through braking and deposit themselves on both the rim and pads. Use a Mavic abrasive rubber block or coarse emery cloth and wipe clean. Carefully remove embedded aluminium from the pads.

3 PAD POINTS

Concave and convex washers provide rotational adjustment in all planes, and are included on many aftermarket pads which can be fitted to side pulls, dual pivots, V-brakes and cantis. Manufacturer Kool-Stop popularised offset pads, which were orientated in such a way that more force was exerted at the front of the pad than the rear, minimising the need for substantial amounts of toe-in while simultaneously curing squashy brakes and squealing. In the late '80s, Shimano introduced offset pads orientated with the long edge forward. Where possible, short edge forward is less prone to noise, but be sure the closed end of the metal pad holders is always pointing forward.

7 V-BRAKES

Toeing-in V-brake pads will require, in most cases, a 5mm Allen key. In some instances, the pad will use a nut on which you can use a 10mm Y-wrench; it will often incorporate an internal 5 or 6mm Allen fitting. One technique suggested by some of the pad manufacturers for setting toe-in is to insert a small piece of folded card between the trailing end of the pad and the rim. This will keep the rear part of the pad further away as you tighten the nut, and can be useful if you're having trouble holding the pad in place by hand. Having the spring unhooked on both sides can also make life easier when positioning pads. Bring the pads against the rim to check they're the correct height, then tighten.

8 CANTI CORRECTING

If your cantilever brakes have an external return spring then it can be easier to position the pads if you unhook the spring first; the arm won't then fight you as you're trying to line up the pad against the rim, and fine tuning will be easier. To toe in the pad use a 10mm spanner to immobilise the brake pad mount, then loosen the front nut using a 5 or 6mm Allen key. Some designs reverse this configuration or even require two 10mm spanners. When setting up the pads, leave roughly a 2mm gap at the back of the pad. If the pad keeps moving back into its previous position, try rotating the washers and clamping the pad either a little higher up or down the arm, to avoid the old marks left by the previous setting.

9 SWAP BRAKE TYPE

Cantilever brakes can be tricky to silence, especially on skinny steel touring forks which are more prone to flexing. One thing that doesn't help is a design that favours noisemaking, where the brake pad post clamp sits way out in front, forward of the arm and mount. If you've tried everything to stop the squealing and still no joy, you might have to resort to a different design altogether. One to consider would be the inboard type pictured here, which seems to squeal less; both Ritchey and Avid offer this more compact design. Compare the forward type pictured in step 8 with the rear mount design pictured above, which minimises flex in the brake arm, reducing the likelihood of high frequency vibration.

ROAD

OFF-ROAD

BEGINNER EXPERIENCED EXPERT

30-40 mins per brake

£30 for a bleed kit
£9 for Dot 5.1 fluid

BLEED SRAM ROAD DISC BRAKES

Learn how to effectively bleed your SRAM hydraulic road disc brakes

1 REMOVE THE PADS

Clamp your bike in a workstand with the top of your brake hoods facing vertically upwards. Remove the wheel from the brake to be bled. Remove the brake pads using a 2.5mm allen key, pulling the pads upwards through the top of the calliper. Use the ring end of a 12mm spanner to carefully push the pistons back into their bores before inserting the plastic bleed spacer.

5 LEVER SYRINGE

Make sure all the air is removed from the second, quarter full syringe, before using a T10 Torx key turned clockwise to remove the bleed screw from the lever – putting it somewhere safe and easily accessible for later. With the screw removed, attach the syringe, turning the fitting clockwise until it's finger tight. Now lock the syringe using the red plastic clip. Double check the system is ready to go by re-reading steps 2 to 5.

6 PUSH FLUID

Release the red plastic locks on both syringes. With the calliper syringe held vertically, press the plunger, pushing the around a quarter of a syringe worth of fluid up through the system and into the lever syringe, making sure not to empty the syringe or overfill the lever one. Air will then exit the system into the lever syringe.

7 PUSH AGAIN

Now, holding the lever syringe vertically, making sure any air that has been pushed through the system doesn't re-enter it, press the plunger on the lever syringe forcing half the fluid inside it back through the system into the calliper syringe. Now repeat step 6, pushing the fluid from the calliper end back up through the system once more, leaving the lever syringe half full.

11 REFIT SCREW

Now the lever is back in its original position, the red plastic levers on both the lever and calliper syringes. Making sure both are locked, get the calliper bleed screw sat on a T10 Torx tool ready to re-install it. Remove the calliper syringe, unscrewing the brass bleed fitting, and quickly replace the calliper bleed screw, tightening it with the T10 Torx tool, being careful not to introduce any air into the system.

12 KEEP IT CLEAN

Clean any fluid lost as you go, using brake cleaner and a rag. DOT brake fluid is harmful to skin and paintwork – so keep things clean. Chances are some fluid will have dripped from the calliper whilst the syringe was being removed, so give it a good clean now.

13 LEVER BLEED

Now that the bleed screw on the calliper has been replaced, unlock the red plastic lock on the lever hose. Holding the syringe vertically, pull on the syringe to create a vacuum (this will suck air from the system), then push the syringe back in, putting pressure into the system. Squeezing the brake lever while pressurising the system will help force any trapped air into the calliper syringe.

- ✓ SRAM bleed kit
- ✓ DOT 5.1 brake fluid
- ✓ 5mm Allen key
- ✓ 4mm Allen key
- ✓ T10 Torx tool
- ✓ Elastic band
- ✓ Brake cleaner
- ✓ Rags

2 PULL BRAKE HOOD

Pull back the hood of the brake lever you're bleeding, revealing the bleed screw. Turning the hood inside out keeps it out of the way for later. If you haven't already, put some workshop latex gloves on now. Making sure the threaded adapters are fitted to the bleed syringes correctly, fill one half full, and one a quarter full of Dot 5.1 brake fluid.

3 PREPARE SYRINGE

Turn one syringe upside-down, so any air that just entered rises to the exit end – give the syringe a tap if air is reluctant to move. Press the plunger on the syringe to get any air out, before squeezing the red plastic 'lock' on the threaded adapter, locking the syringe. Now pull the plunger, creating a vacuum and bringing out any tiny air bubbles from the fluid. Unclip the red lock then squeeze out any excess air again. Repeat this on both syringes.

4 CALLIPER SYRINGE

Now you're ready to attach the syringes. Use a T10 Torx tool to turn the bleed port screw on the calliper anticlockwise to remove it. Once it's removed, put it aside, somewhere easily accessible for later. Check there is no air left in the half full syringe before screwing it clockwise into the bleed port fingertight. Once the syringe is fitted to the calliper, squeeze the red plastic clip to lock the syringe again.

8 LOCK THE LEVER

Now the lever and the calliper can be vacuum bled to remove any remaining air. Use an elastic band wrapped between the bar and the lever to effectively press the lever, holding it in place. This effectively 'locks off' the lever, isolating it so you can bleed air from the calliper.

9 PULL SYRINGE

With the lever held firmly, pull on the calliper syringe to create a vacuum. As you pull, you should be able to feel the vacuum though the syringe as it's trying to return to it's original position. After a 5 second vacuum, push the syringe again, reintroducing fluid into the system where the air has been removed. Repeat until there is no more air leaving the calliper.

10 REFILL LEVER

With no more air emerging from the calliper, remove the elastic band from the lever, controlling the lever's return with your hand while pressing on the calliper syringe, pressurising the system. Keep that pressure on until the lever is back to being in its original position.

14 REFIT SCREW

Once there is no more air leaving the system and entering the syringe, the lever bleed screw needs refitting. Sit the screw atop the T10 Torx tool ready for re-installation, before pressurizing the system one last time, then unscrewing the lever syringe, removing it from the brake lever. Re-fit the bleed screw, tightening it with the T10 Torx tool, losing as little fluid as possible and making sure not to introduce any air into the system.

15 CLEAN UP

Fluid will be lost, so don't fret – concentrate on keeping air out when re-fitting the bleed screw. Now the brake is bled, it's time to clean up. Using brake cleaner and a rag, spray and wipe any areas that have been subject to any brake fluid. Remove the bleed spacer from the calliper and give the calliper a good clean too. It's also a good idea to clean your tools that have come into contact with the fluid too.

16 FINISH OFF

Now re-fit your brake pads, wheel and then reposition the lever to it's original location on the bar. Squeeze the brake repeatedly until it has a good, solid feel to it. Re-align the calliper, loosening the T25 Torx key fixing bolts, squeezing the lever and then re-tightening them, after which, upon spinning the wheel, the brake should be rub free.

ROAD
OFF-ROAD

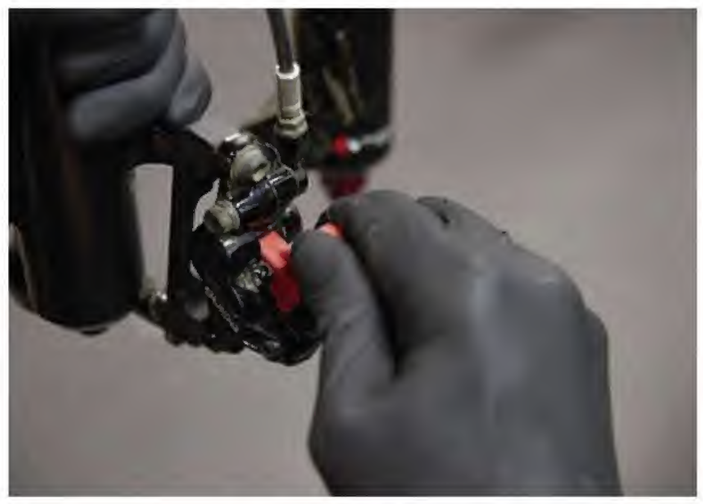
BEGINNER EXPERIENCED EXPERT

30 mins per brake

£25-£45 for a SRAM bleed kit

HOW TO BLEED SRAM GUIDE BRAKES

Follow these 16 simple steps to get your SRAM Guide R, RS, RSC or DB5 disc brakes working at their best



1 REMOVE THE PADS

Clamp your bike in a workstand and remove the wheel and brake pads. Use the ring end of a 12mm spanner to carefully push the pistons back into their bores, then wedge a plastic bleed spacer between them. Thread the brass adapters onto the syringes. Put on safety glasses and gloves, then use fresh DOT 5.1 brake fluid to half fill one syringe and quarter fill the other.

5 POSITION THE LEVER

Rotate the lever on the bar so the blade points down at 45 degrees from horizontal – you'll need a T25 Torx key to loosen and then retighten the clamp bolt. Turn the lever reach adjuster clockwise until it stops, then turn it anticlockwise two full turns. On Guide RSC brakes, also wind the contact point adjuster in the opposite direction to the arrow until it stops.

6 ATTACH THE SYRINGE

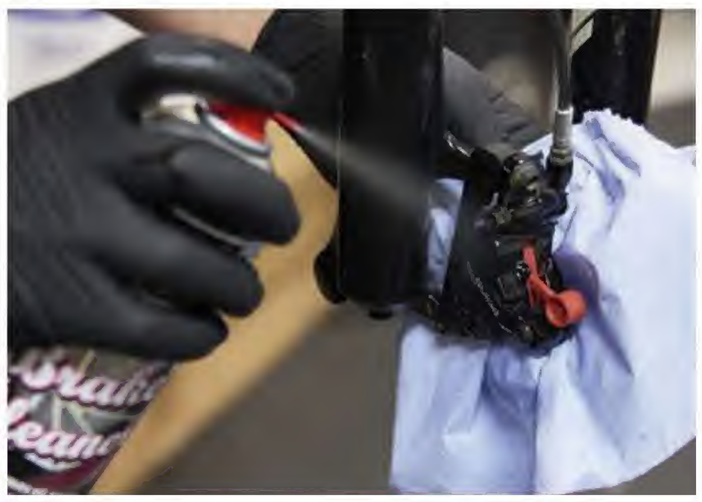
Make sure all the air is removed from the second syringe and that the red plastic clip is closed. Use a T10 Torx key to remove the bleed port screw from the lever, turning it anticlockwise. Put it somewhere safe. Attach the syringe, turning the brass fitting clockwise until it's finger tight. Check you've completed steps 3 to 6 correctly.

7 PURGE THE SYSTEM

Release the red plastic locks on both syringes. With the calliper syringe held vertically, press the plunger, pushing until you've emptied around half of the fluid into the system. This should leave the calliper syringe a quarter full and the lever syringe half full. It's important not to empty the calliper syringe or overfill the lever syringe.

11 REFIT BLEED PORT SCREW

Close the red plastic clips on both syringes. Making sure that the calliper bleed screw you removed earlier is close to hand, remove the calliper syringe by unscrewing the brass bleed fitting, turning it anticlockwise. With the T10 Torx tool, replace the bleed screw quickly, being careful not to introduce any air into the system.



12 CLEAN THE CALLIPER

DOT brake fluid is harmful to your skin and to your bike's paintwork, so make sure to clean up any spillages as you go, using brake cleaner (or water) and a rag. The chances are that some fluid will have dripped from the calliper while the syringe was being removed, so make sure to give it a thorough clean now.

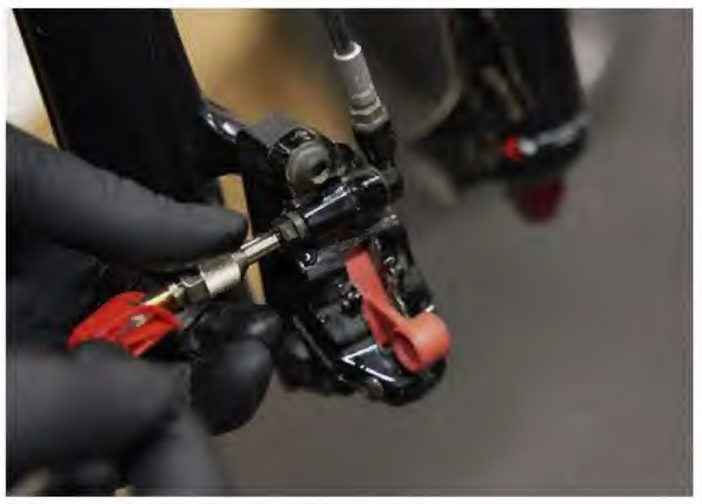
13 BLEED THE LEVER

Unlock the red plastic clip on the lever syringe hose. Holding the syringe vertically (with the brass adapter downwards), pull on the plunger to create a vacuum and then push it back in to pressurise the system. Flick the brake lever a few times. Repeat this step until there's no more air or only the tiniest amount escaping into the syringe.

- ✓ Toe strap (or rubber band)
- ✓ 12mm ring spanner
- ✓ SRAM bleed syringes
- ✓ T25 and T10 Torx keys
- ✓ 5mm Allen key
- ✓ Plastic bleed spacer
- ✓ Plastic pad separator tool
- ✓ Workshop gloves
- ✓ Disc brake cleaner (can use isopropyl alcohol instead)
- ✓ Workshop rags
- ✓ Protective glasses
- ✓ Freshly opened DOT 5.1 fluid
- ✓ Workstand

WORKSHOP WISDOM

SRAM brakes have a reputation for being really fiddly to bleed but if you follow the above steps to the letter you should be fine. If the lever still feels spongy after bleeding there are two likely causes. Firstly, it's important to only use freshly opened brake fluid. Like milk, DOT fluid goes off a while after opening. Secondly, check that all four pistons are advancing in sync. With the pads removed, squeeze the lever while looking through the calliper. If one piston is moving out faster than the others, hold this one back with a 12mm ring spanner and squeeze again. Repeat until all the pistons advance at the same speed.



2 SET UP THE SYRINGES

Turn one of the syringes upsidedown. Hold a rag around the end in case of spillage and press the plunger. Once any trapped air has been expelled close the red plastic clip to lock the syringe. Now pull the plunger to create a vacuum. Hold it for 30 seconds while flicking the syringe to draw out any air bubbles. Unlock the red clip, then squeeze out any air again.

3 REMOVE BLEED PORT SCREW

Repeat step 2 on the second syringe. Now you're ready to attach both syringes to the brake. Use a T10 Torx key to loosen and then remove the bleed port screw on the side of the calliper, turning it anticlockwise. Put it somewhere safe. Double check the half-full syringe to make sure there's no air still inside before attaching in step 4...

4 ATTACH THE SYRINGE

Take the half-full syringe, making sure that the fluid has been pushed right to the tip and is free of air bubbles, and that the red plastic clip is closed. Screw the brass fitting on the end of the syringe into the open calliper bleed screw port, turning it clockwise. It only needs to be finger tight because the O-ring on the threaded adapter will create a seal.

8 LOCK OUT THE LEVER

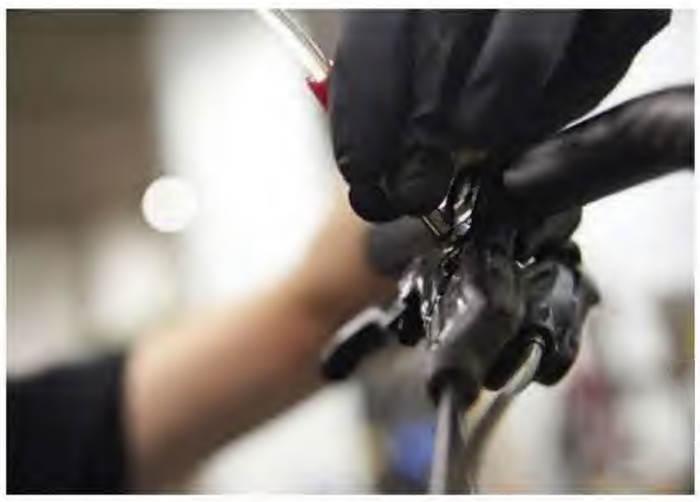
Now the lever and calliper can be vacuum bled to remove any remaining air. Close the red clips on the lever syringe. Wrap a toe strap or rubber band around the bar and the brake lever, ensuring that it clamps the lever tightly and securely against the bar. This will lock out the lever, isolating it so that you can bleed air from the calliper.

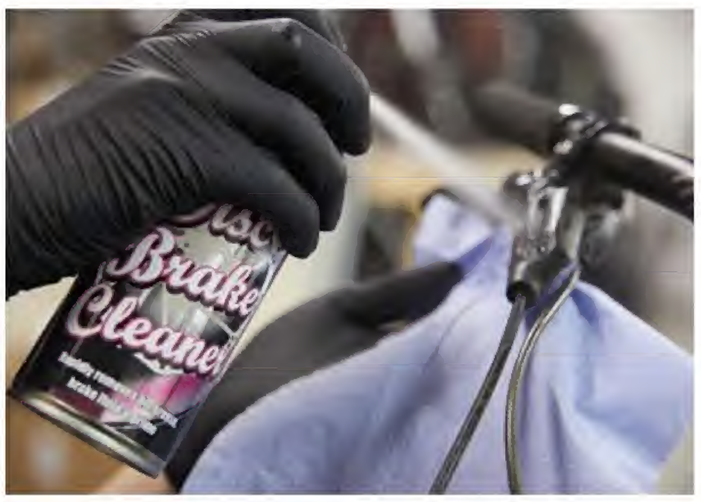
9 BLEED THE CALLIPER

Holding the calliper syringe vertically, pull on the plunger to create a vacuum and then tap the calliper with a blunt plastic object. Bubbles should emerge from the calliper and rise into the syringe. When they stop, push the plunger back in. This will reintroduce fluid into the system where the air has been removed. Repeat until there's no more air leaving the calliper.

10 REPRESSURISE THE SYSTEM

It's now time to remove the toe strap or rubber band, making sure that you keep the lever blade pressed to the bar with your other hand while you do so. Once the strap/band is off, apply pressure to the calliper syringe plunger and slowly release the brake lever. Continue to apply pressure as the lever returns gradually to its original position, pressurising the system.





14 REFIT BLEED SCREW

Sit the lever bleed screw atop the T10 Torx tool ready for reinstallation. Push the plunger down one last time before unscrewing the brass fitting from the brake lever. Refit the bleed screw, losing as little fluid as possible and making sure not to introduce any air into the system. Fluid will be lost, so don't fret – concentrate more on keeping air out.

15 CLEAN UP THE LEVER

Now the brake is air free and successfully bled, it's time to clean up. Use brake cleaner (or water) and a rag to wipe any areas that have been in contact with brake fluid. Remove the bleed spacer from the calliper and give the calliper a good clean too. It's also a good idea to clean any tools that have come into contact with the fluid. Take off your gloves.

16 REFIT THE BRAKE PADS

Refit the brake pads, using a plastic pad separator tool to space them correctly. Reinstall the wheel. Return the lever to its original angle, reach and contact point settings. Squeeze it repeatedly to check for a solid, crisp feel. Realign the calliper by loosening the 5mm Allen bolts that hold it to the fork or stay, squeezing the lever and then retightening the bolts.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

30 mins

Hose olive & crush washer £6, brake oil £13, bleed kit approx £30

TRIM AND BLEED SHIMANO BRAKE HOSES

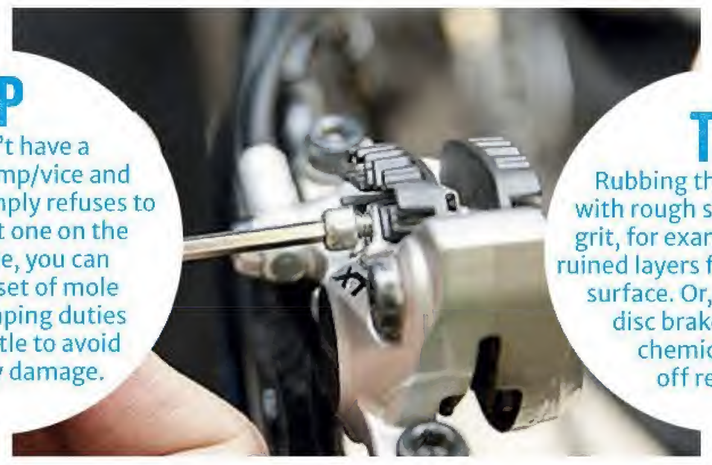
Huge arcs of brake cable protruding in front of your bar? De-clutter your cockpit by trimming your brake hoses and restore full braking power by bleeding the brakes too

1 CLEAN UP

Before you start, it makes things easier if you give your bike a thorough clean. Focus on areas near and around the brake callipers and hoses. Wipe down with a rag to dry them out as much as possible. As with many other workshop tasks, it's much easier with the bike in a stand, and if possible, positioned close to a bench vice.

TIP

If you don't have a workshop clamp/vice and your partner simply refuses to let you mount one on the kitchen table, you can substitute a set of mole grips for clamping duties – but be gentle to avoid causing any damage.



TIP

Rubbing the brake pads with rough sandpaper (250 grit, for example) can clean ruined layers from the braking surface. Or, use a specific disc brake cleaner to chemically strip off residues.

5 REFIT THE FITTINGS

Slide the rubber cover, hose bolt and brass olive onto the hose (in the same order as removed) before lightly clamping it into the bench vice using the hose blocks from the bleed kit. If you don't have any blocks, you can substitute a vice with an old inner tube wrapped around the jaws to help grip the hose and reduce damage. Push the brass-connecting insert into the hose, then gently tap it in further with a rubber mallet.

6 CHECK PADS FOR WEAR

Remove the relevant wheel, take out the pads and inspect them – if one pad is more worn than the other, or they're worn unevenly across their surfaces, this indicates the calliper needs attention. Lightly squeeze the lever – just a fraction – and watch the pistons. If they don't slide out evenly, apply a small amount of brake fluid around the seals and try again.

7 NEED TO BLEED?

To check whether you need to bleed the lines, use a plastic tyre lever to gently press the pistons into the calliper, insert the (model-specific) bleed block, and squeeze the lever. If it feels firm you can skip to Step 16. If the lever is mushy, there's air in the system that needs removing (air can be compressed, allowing the lever to move without the pads squeezing any harder).

11 PUT THE OIL IN

Gently squeeze the syringe and keep an eye on the oil funnel. You'll see the oil that's being pushed through coming out, and chances are it will have air bubbles in. Keep adding oil until there are no more air bubbles. Temporarily close the nipple.

12 DRAIN THE EXCESS OIL

Remove the syringe from the tubing and drain the excess oil back into the bottle. Connect the oil bag to the tubing and loosen the bleed nipple an eighth of a turn; oil should naturally flow through the system (thanks to gravity) and drain into the bag. You'll also see air bubbles in the clear plastic tube.

13 CHECK THE OIL LEVEL

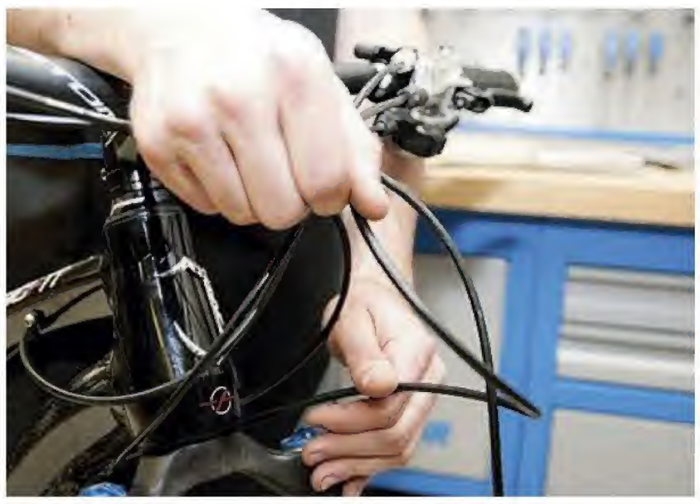
As the oil drains, keep an eye on the level in the funnel. Keep it topped up to prevent more air entering the system. To get rid of any air trapped in the calliper, gently squeeze the brake lever to the bar. When it looks like no more air is coming out of the tube, gently tighten the nipple back up.

- ✓ Shimano bleed kit
- ✓ 2/2.5/3/ 4mm Allen key
- ✓ 7/8mm open wrench
- ✓ Torque wrench
- ✓ Plastic tyre lever
- ✓ Philips screwdriver
- ✓ Hose cutters
- ✓ Oil pan or bucket
- ✓ Isopropyl alcohol
- ✓ Bleed bottle
- ✓ Section of clear hose
- ✓ Bleed blocks
- ✓ Workshop vice/clamp
- ✓ Bike stand
- ✓ Rags
- ✓ Marker pen
- ✓ Mallet

WORKSHOP WISDOM

Wearing a set of rubber gloves and eye protection while bleeding brakes is a good idea. Brake fluid can irritate skin, even the less corrosive mineral type used in Shimano systems.

Disconnected brake hoses have a nasty habit of flicking fluid if they get caught and the last place you want it going is your eye, so consider breaking out your clear riding glasses to protect yourself.



2 CHECK YOUR ROUTING

Many brand new bikes have a real mess of cables in front of the bars, thanks to the long default hoses of complete brake systems. Turn your bars 90 degrees to the right and left to check for any snagging or odd looping twists that threaten to damage the hose or catch a stray branch mid-ride.

3 MEASURE YOUR NEW ROUTING

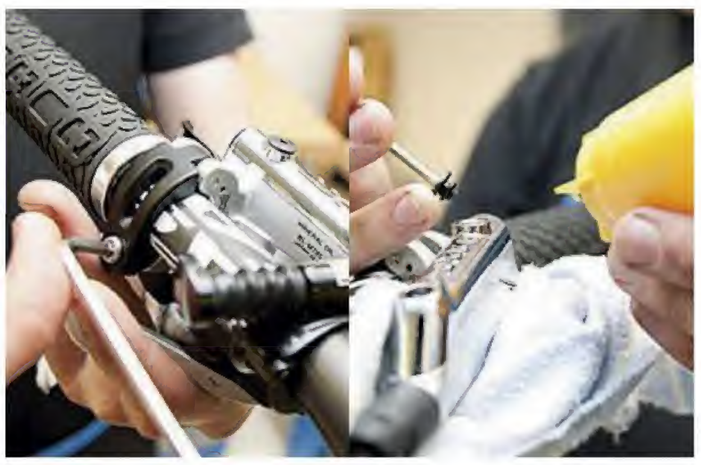
The aim is to create the smoothest and most direct routing. Shorter is better, but don't go too short: use an old section of hose or cable outer to help work out how short you can go. Turn the bars right round to check there's still slack – if there isn't, a crash could wrench the hose right out. Mark on your current hose how much you need to trim away. Oh, and then measure it again – measure twice, cut once!

4 DISCONNECT THE HOSE

Slide back the rubber cover on the lever to expose the bolt. Using an 8mm open-ended spanner, disconnect the hose (turning anti-clockwise) and put the nut and washer to one side, somewhere safe . Keep the hose vertical with the end pointing up and, using sharp outer-cable snips or a hose-cutting tool, trim the hose to your pre-marked length. Aim to make the cut as clean and square as you can.

8 PREPARE TO BLEED

Drape a clean rag around the calliper, as close to the bleed nipple as possible, and wrap another around the lever. Put a bucket directly underneath the lever to catch the drips the overfill bleed technique creates. Have an extra rag close to hand as well.

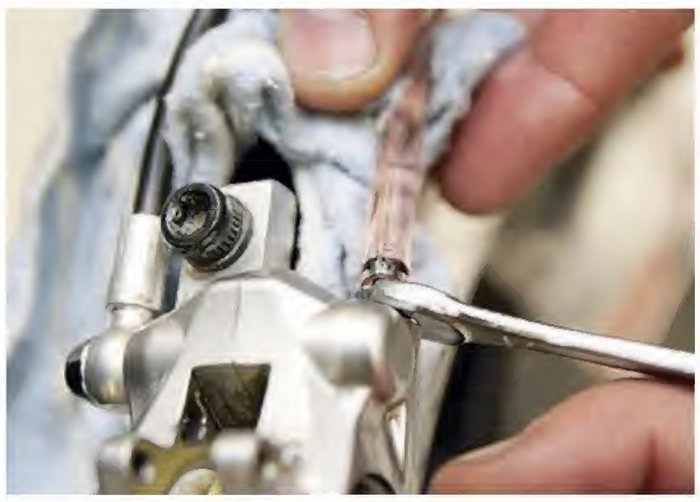


9 LOOSEN THE LEVER

Loosen the brake on the bar and angle it approximately 45 degrees to the floor, putting the bleed screw roughly parallel with the floor. Remove the bleed screw (closest to the lever clamp) with a 2.5mm Allen key, along with the small O-ring behind it.

10 SET UP THE SYRINGE

Carefully insert the oil funnel into the bleed screw port on the lever. Slot the 7mm spanner over the nipple on the calliper, and attach the plastic tubing to the syringe. Fill the syringe with mineral oil. Gently push the end of the plastic tube with the syringe attached onto the bleed nipple. Turning the spanner in an anti-clockwise direction, loosen the bleed nipple by an eighth of a turn to 'open' it.



14 FINISH THE CALLIPER

With the lever depressed, rapidly open and close the bleed nipple (being as gentle as possible). It only needs to be open for about half a second at a time to be effective. Do this two to three times – watch the tube for bubbles. Finally, re-tighten the bleed nipple to the 4-6Nm torque setting, using a torque wrench. Release the lever.

15 REMOVE THE FUNNEL

Gently squeeze the lever again. Any remaining air bubbles should appear in the oil funnel. When these stop appearing, release the lever fully. Insert the stopper in the funnel (O-ring down) to plug it. Wrap a towel around the lever ready to soak up any spilt oil, and remove the funnel from the port.

16 DO THE FINAL CHECK

Replace the bleed screw and O-ring, tightening it to 0.3-0.5Nm (some oil will squeeze out as you do it). Spray the calliper and brake lever with degreaser or isopropyl alcohol, then wipe dry. Replace the brake pads and spring in the calliper. Reposition the brake levers, tighten them, and go for a gentle spin – check they work correctly before relying on them!

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

60 mins

£23 for Formula bleed kit

BLEEDING FORMULA HYDRAULIC BRAKES

If your levers feel squishy or braking has become inconsistent, it's likely air has got into the system. Here's how to get them back to full power

1 WEDGE THE PAD

Clamp your bike in a workstand. Remove the front wheel if you want to bleed the front brake, and vice versa. Check that the brake pads still have a good amount of material left but leave/refit them in the calliper. Then carefully wedge the Formula pad spacer that should have been supplied with your brakes or bike in between the pads, pushing the pistons back into their bores.

TIP

DOT brake fluid really is a nasty substance, so make sure you wear gloves. Protective eyewear is a good idea too. And if you do get any on your skin, be sure to give the area a thorough wash.

5 DRAIN SYSTEM

Place your waste brake fluid tray underneath the calliper. Then squeeze the brake lever repeatedly to drain the system of fluid. Be careful not to get brake fluid on your skin, clothes or on the brake pads in the calliper if you plan to re-use them.

6 ATTACH SYRINGE

Attach the syringe filled with 20ml of fluid to the calliper, screwing the brass fitting on the end of the syringe into the calliper's bleed port. Turn it clockwise until finger-tight. Be careful not to lose or damage the bleed port O-ring in the process.

7 LET THE FLUID FLOW

Use the T10 Torx key to remove the bleed port screw from the brake lever body, turning it anticlockwise. Be careful not to lose the bleed port O-ring. Attach the remaining syringe filled with 5ml of fluid to the lever's bleed port, turning the brass fitting clockwise until it's finger-tight.

11 REMOVE LOWER SYRINGE

Hold the lever syringe in the vertical position. Then pull on the calliper syringe's plunger, creating a vacuum in the calliper syringe. This will pull fluid back through the system, so keep an eye on the lever syringe's fluid level and make sure it doesn't drop below 5ml. The fluid entering the syringe should now be free of air bubbles.

12 REMOVE LEVER SYRINGE

Remove the calliper syringe from the calliper, turning the brass bleed fitting anticlockwise and being careful not to lose the bleed port O-ring. Put the syringe to one side, then refit the bleed port screw with a torque wrench, turning it clockwise until you reach 2Nm.

13 CLEAN-UP FLUID

Remove the lever syringe, turning the brass fitting anticlockwise. Put the syringe to one side and refit the bleed port screw using the Torx key, making sure the bleed port is brimming with fluid and the O-ring is still sat in place inside. Tighten the bleed port screw to 2Nm.

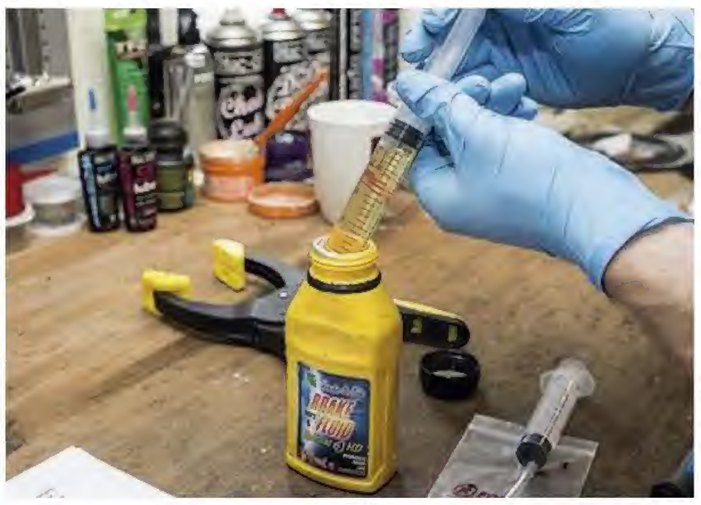
- ✓ Brake cleaner
- ✓ 2 T10 Torx key
- ✓ 4mm Allen key
- ✓ 3mm Allen key
- ✓ 2.5mm Allen key
- ✓ Torque wrench
- ✓ Rag
- ✓ Waste brake fluid tray/ plastic tub
- ✓ DOT 4 brake fluid
- ✓ Formula pad spacer
- ✓ 10 Formula bleed kit
- ✓ Workstand
- ✓ Ziptie
- ✓ Latex gloves

WORKSHOP WISDOM

Because the Formula bleed process requires you to leave a set of brake pads in the calliper, you may want to save a part-worn set of pads for this purpose, rather than risking contaminating a newer set.

2 POSITION LEVER

You now need to position the brake lever so that the bleed port is pointing upwards. The bleed port is located at the base of the lever body, between the hose entry point and the bar clamp, so you'll need to remove the lever from the bar using a 3 or 4mm Allen key and then use a ziptie to reattach it to the bar with the bleed port pointing skyward.

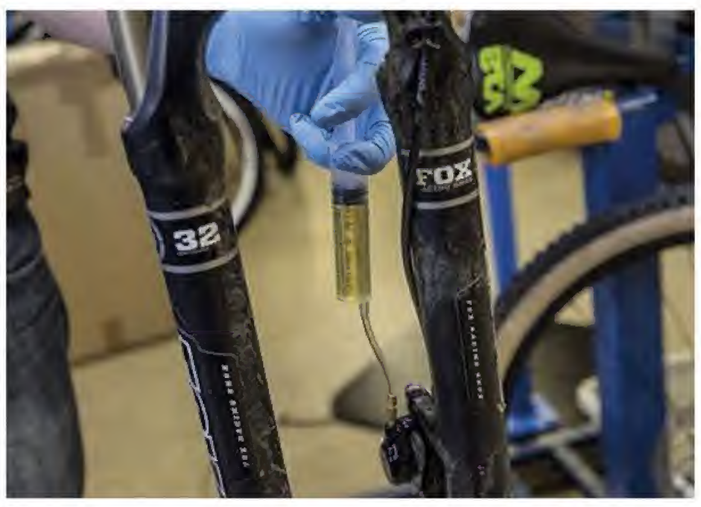


3 FILL SYRINGES

Now it's time to start the bleed. First, put your latex gloves on – DOT brake fluid isn't good for your skin (or your bike's paintwork, for that matter). Next, make sure the syringes from the bleed kit are correctly assembled, with the tubes and brass bleed fittings in place. Fill one syringe with 20ml of DOT 4 brake fluid and the other with 5ml.

4 REMOVE PORT SCREW

Use a T10 Torx key to remove the bleed port screw from the brake calliper, turning it anticlockwise. Be careful to leave the bleed port O-ring in position inside the bleed port.



8 KEEP LEVER CLOSED

Hold the calliper syringe vertical and push around two-thirds of the fluid through the system. The lever syringe should fill with a mixture of air bubbles and fluid.

9 FORCE OUT AIR

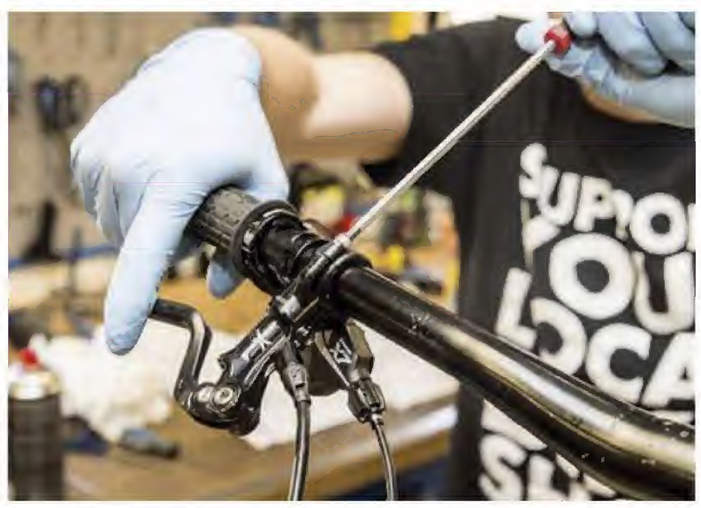
Now hold the lever syringe vertical. If there are air bubbles visible in the fluid, give the syringe a light tap – this should encourage the bubbles to rise. Keep tapping until the bubbles have reached the top of the fluid. Now force around two-thirds of the fluid back through the system, watching for air bubbles entering the calliper syringe.

10 PUMP THE FLUID

Holding the calliper syringe in the same vertical position as before, push the same amount of fluid back though the system again, this time while pumping the brake lever repeatedly. More bubbles of air will work their way into the lever syringe.

TIP

You can substitute the pads and spacer for a well fitted universal bleed block, or just cover the top of the calliper with some small pieces of insulation tape to avoid fluid dripping on to the pads.



14 TEST THE SYSTEM

Use brake cleaner and a clean rag to clean any surface that brake fluid has come into contact with during the bleed. Pay particular attention to the calliper, as well as to the lever body. Remove the Formula pad spacer and check the pads haven't come into contact with any brake fluid.

15 BACK ON THE BIKE

If you've spilled any fluid on your brake pads, you'll need to replace them. Use a 2.5mm Allen key to remove the pad-retaining pin, then remove the pads. Give the calliper a thorough clean with brake cleaner before fitting new pads and replacing the pad retaining pin.

16 FINISHING TOUCHES

Re-adjust your brake lever so it's back in its original position. Refit your wheel, then test the brake to make sure the bleed has been successful. If you've fitted new pads, be sure to bed them in before you go smashing any big descents!

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

40 mins

£33 for Magura bleed kit and mineral oil

HOW TO BLEED YOUR MAGURA MT5 BRAKES

Follow this simple guide to get your Magura four-pots working at their best.

1 GET BIKE IN POSITION

Clamp the bike in a workstand, angling it so that the bleed port on the calliper you want to bleed is at the highest point of the calliper. For the front brake, the bike needs to be upright. For the rear, you may have to remove the calliper from the frame. Use a 5mm Allen key to undo the bolts, turning them anticlockwise and position the calliper so the bleed port is on top.

5 POSITION LEVER

Use a T25 Torx key to loosen the lever clamp bolts, turning them anticlockwise. Then swing the lever around the handlebar so that it's positioned horizontally. Retighten the bolts (don't exceed 4Nm of torque) and make sure that the handlebar won't move during the bleed.

6 SET UP BLEED KIT

Unpack the Magura bleed kit. Take the bleed tube and insert the bleed barb into one end until the collar on the barb is flush with the end of the tube. Slide the other end of the tube over the whole tip of the syringe. Drop the barb into the bottle of mineral oil. Pull on the plunger to draw up oil until the syringe is almost full. Ensure there are no air bubbles in the tube.

7 PREPARE CALIPER

Use a T25 Torx key to unscrew the bleed port screw on the calliper, turning it anticlockwise. Set it aside somewhere clean and safe, then quickly thread the syringe into the bleed port, turning the bleed barb clockwise. Tighten the bleed barb with an 8mm spanner, turning it clockwise, until snug (do not exceed 4Nm).

11 PULL BACK ON SYRINGE

Pull on the calliper syringe plunger to draw oil back out of the system and into the calliper syringe. Be sure to stop while there's still oil left in the lever syringe to prevent any air getting sucked into the lever. Now repeat steps 9 to 11, cycling oil through the system and drawing air out. Stop when there are no more bubbles appearing in the lever syringe.

12 REMOVE LEVER SYRINGE

Carefully pull out the lever syringe and immediately wrap the end in a cloth so you don't spill any oil.

13 REFIT LEVEL BLEED SCREW

Gently push the calliper syringe plunger until the oil level at the lever bleed port sits flush with the top of the bleed port. Reinstall the lever bleed port screw, turning it clockwise and being careful not to overtighten it – just 0.5Nm max.

- ✓ Magura pad spacers
- ✓ Magura bleed kit including mineral oil
- ✓ Clean rags or paper towels
- ✓ Workshop gloves
- ✓ 5mm Allen key to remove calliper
- ✓ 8mm spanner
- ✓ T25 Torx key
- ✓ Brake cleaner
- ✓ Rubber bands
- ✓ Workstand

WORKSHOP WISDOM

Covering the brake calliper with mineral oil is pretty much inevitable during bleeding, and if you don't clean it properly afterwards, the oil can spread to the pads and rotor. This will leave you with far less power than when you started, not to mention a ruined set of pads. To prevent this, always wear a fresh set of gloves for cleaning up, use a quality cleaner like Muc-Off Brake Cleaner and be really liberal with it! Leave the cleaner plenty of time to do its work before using clean rags or paper towels to wipe away any remaining oil. If you don't do this, you'll need to replace the pads and clean the rotor too. You only make that mistake once!

2 PUSH IN PISTONS

Remove the wheel from the bike. Use the Magura pad spacer or a large, flat-headed screwdriver to push the brake pads apart until the pistons are completely retracted.

3 REMOVE BRAKE PADS

Now it's time to remove the brake pads from the calliper. With clean hands, or wearing workshop gloves, use your fingers to push one of the pads into the centre of the calliper. Once it's unhooked from the calliper body, pull it out through the underside of the brake. Remove the second pad in the same way. Set the pads aside somewhere clean and safe.

4 PUT SPACERS IN PLACE

Two pad spacers are required per calliper to stop the pistons moving out during the bleed. Insert the broader end of each spacer first and wrap rubber bands around the calliper and spacers to hold them securely in place.

8 PREPARE LEVER

Use a T25 Torx key to remove the bleed port screw on the lever, turning it anticlockwise. Set it aside somewhere clean and safe. Push the tip of the other syringe directly into the bleed port as shown above.

9 PUSH OIL THROUGH

Press the plunger on the calliper syringe. This will force oil up through the system and out into the lever syringe. While doing this, tap on the lever body with your finger to help dislodge any air that might be trapped in the system. Stop pressing the plunger when the calliper syringe is half full.

10 SQUEEZE BRAKE LEVER

Quickly squeeze and then release the lever several times while gently pushing the calliper syringe plunger until there's only a little oil left. Be sure to stop while there's still oil in the syringe so as to ensure no air is introduced back into the system.

14 REMOVE CALIPER SYRINGE

Use an 8mm spanner to remove the syringe from the calliper, turning it anticlockwise. Quickly reinstall the bleed port screw, turning it clockwise with a T25 Torx key. Tighten it to 4Nm. Give the lever a squeeze. Check for leaks at both bleed ports, the lever, calliper and all hose entry/exit points. Also check for feel – does the brake feel spongy? If so, repeat steps 7 to 14.

15 REFIT PADS

Remove the pad spacers. Clean the brake thoroughly with a dedicated disc brake cleaner. Reinstall the pads one at a time by pushing them up through the calliper and using the hooks to clip them into place. Reinstall the wheel. If necessary refit the calliper, aligning it with the rotor and tightening the bolts (turning them clockwise) to the frame manufacturer's torque specs.

16 PRE-RIDE CHECK

Give the newly bled brake a few squeezes to check that it feels consistent. A quick lap of the car park to make sure the brake is working correctly is always a good idea before hitting the trails.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

45 mins

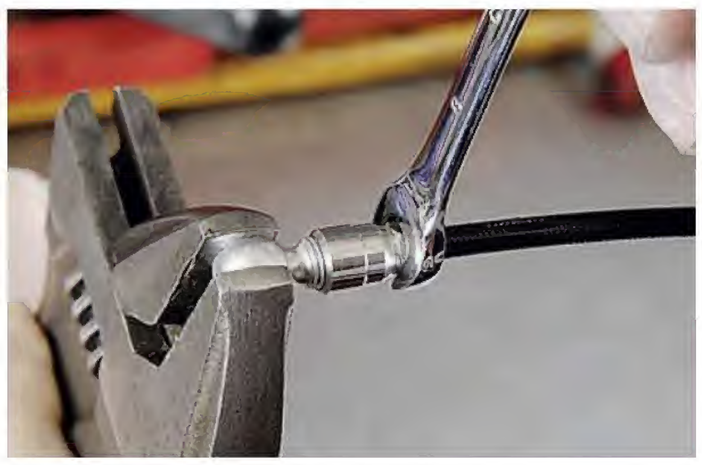
£19-35 for hose kit and fluid

CHANGING A HYDRAULIC DISC BRAKE HOSE

Either replace disc brake hoses like-for-like or upgrade to robust and trick-looking braided lines. Changing hoses isn't difficult, as long as you know what you're doing

4 ASSEMBLE FITTINGS

Take the new hose that's been cut to length and assemble it before removing the old hose. Ensure that the fittings are assembled in the correct order – check with your brand's manual for the proper fittings and their assembly order, because all brake brands differ. The fittings for Formula Oro brakes are shown above.



5A THEN TIGHTEN..

Press the fittings onto to the end of the hose in the correct assembly order and then, using an adjustable spanner, hold the fitting banjo and tighten the compression fitting. Some brands are designed to fit nice and snug (such as Formula), while others (such as Hayes) are designed to deform. Just tighten the fitting until it's deformed.

5B OR SIMPLY SCREW IN

Other brands, including Shimano and Magura, use direct connectors rather than banjo fittings that screw into the reservoir body of the lever. Assemble the compression fittings as per the manufacturer's instructions outlined in step 5a. Be careful not to over-tighten them, though.

8 DISCONNECT THE OLD HOSE

Time to use the gloves and eye protection. Lay the system on a bed of paper towels. For a banjo-type connector brake (Formula, Hope, Avid) take the old hose off the lever using an 8mm spanner to undo the lever banjo (or 6mm for some brands). It will require some force. Then unscrew by hand. Discard the O-rings and replace with new ones – do not reuse them. Do similarly with the calliper connection. For an M8 direct lever fitting (used by Hayes Nine, Shimano fittings, and Magura) use an 8mm/6mm (depending on brand) open spanner (also a slotted spanner is good) to unscrew the M8 fitting and pull the hose clear of the lever. Again, discard the O-rings and replace with new ones. Then remove the calliper banjo fitting as outlined above.

9 REPLACE ALL FITTINGS

Now it's time to put the new hose on. Always use fresh fittings each time you assemble a hose – be that O-rings, compression fittings, etc – as most fittings are designed for single use. If you're not sure, assume it's single use. Assemble in the correct order according to the manufacturer's instructions. When it comes to replacing the O-rings, fit one O-ring above and one O-ring below the banjo.

10 FIT NEW HOSE

Using an 8mm spanner, tighten the fittings onto the calliper and, if you can, use a torque wrench to ensure that the system is fitted to the manufacturer's recommended torque. Repeat for the lever. Your new hose is now fitted to your brake.

- ✓ Protective vinyl gloves,
- ✓ Bleed kit,
- ✓ Fluid and instructions (brand specific, so check if you need DOT or mineral oil for your system),
- ✓ Hose replacement kit,
- ✓ Knife or cable cutters,
- ✓ 4 & 5mm Allen keys,
- ✓ Torx T-25 driver,
- ✓ 8mm or 6mm spanners

WORKSHOP WISDOM

DOT4 fluid is an environmentally hazardous and highly corrosive substance and should be treated with suitable respect, handled with the correct protective precautions and disposed of only in an appropriate manner for a corrosive substance. You should not handle it without protective gloves, for obvious reasons.

1 MEASURE UP

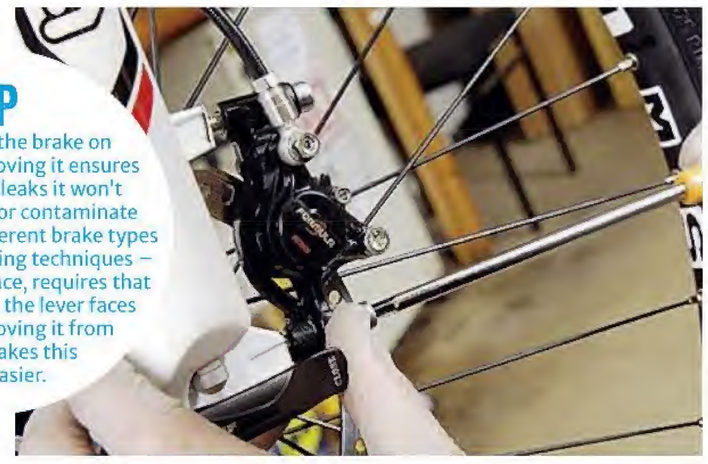
Measure the replacement hose against the old hose still on the bike, making sure that you route it exactly as you would once it's fitted. Ensure that there is enough hose for when the suspension is fully extended and compressed. Activate the suspension and check any adjustable travel/ geometry settings to prevent problems.

TIP

You can bleed the brake on the bike, but removing it ensures that if any fluid leaks it won't damage the bike or contaminate any parts. Also, different brake types use different bleeding techniques – Formula, for instance, requires that the bleed port on the lever faces upwards. Removing it from the bike makes this much easier.

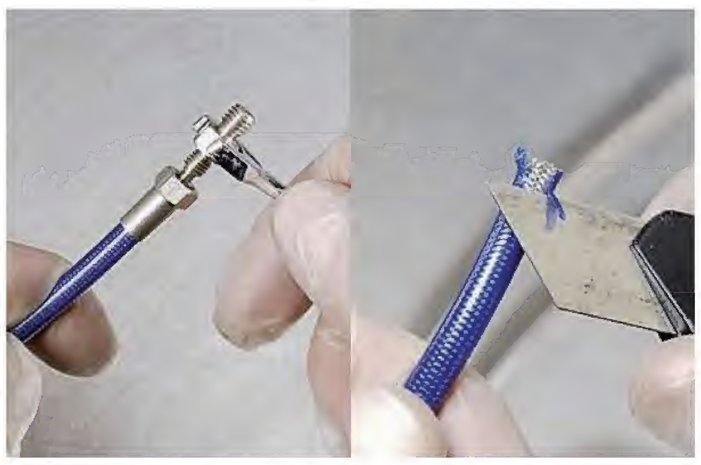
2 CUT THE HOSE TO FIT

Cut the hose to length using a sharp Stanley knife if you're using a standard plastic hose replacement. If you're using a braided hose, then use a cable cutter for a good clean cut. You can also use a pipe cutter – it makes the job much easier – and they cost around £20 from all good hardware stores.



3 REMOVE BRAKE TO BLEED

If your frame has fixed cable guides then you have to assemble and bleed the system in-situ on the bike. If not, then it's best to take the whole system off the bike and to replace and bleed the hose off the bike (to prevent any fluid leaks damaging the paint, etc). To do so, remove the lever and the calliper from the bar and frame using 4 and 5mm Allen keys (4mm or a Torx T-25 at the lever and 5mm at the calliper).



6A GOODRIDGE SCREW-TYPE

With Goodridge (classic Goodridge size hose, not the new narrow stuff), strip back 8mm of the braided outer using a Stanley knife and put the collar (called a ferrule by Hel) in place on the outer and then screw the direct connector into the collar. Make sure to leave a tiny gap of less than 1mm between the connector.

6B HEL SWAGED OR CRIMPED-TYPE

Strip back 8mm of the outer braided hose and put the ferrule in place. Instead of screwing the hose into the fitting, press the barbed fitting into the hose as far as it will go. Then put the fitting into the tool in the vice and tighten it to nudge the collar onto the barbed fitting. The banjo can rotate for easy fitting onto the brakes.

7 PROTECT THE PADS

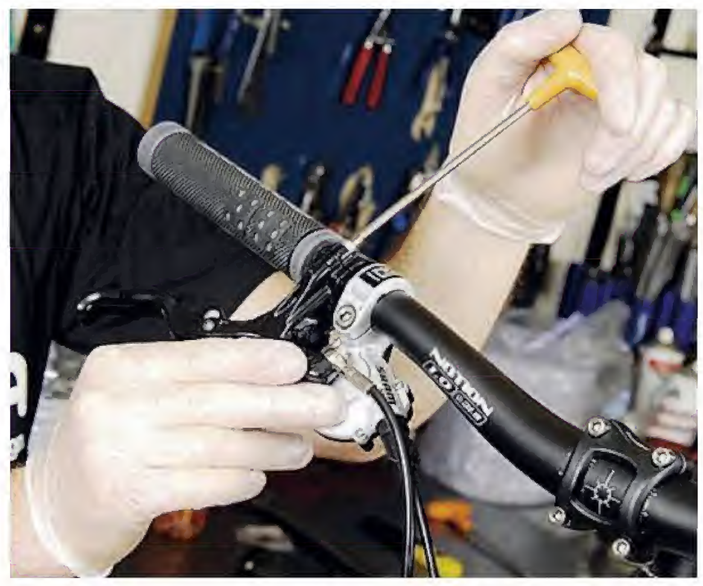
Take the pads out of the calliper and then push the pistons back as far as they will go to avoid the risk of contaminating the pads with brake fluid when you remove the hose.

11 FEED IN THE FLUID

Now you have to bleed the brake (see pages 58 to 65). Using an old handlebar clamped vertically in your vice (for Formula, as the lever bleed screw has to point upwards) and clamp the calliper on its side so that its bleed port is also pointing vertically.

12 TEST THE NEW SYSTEM

Replace the brake pads and test the brake system by placing the calliper over the disc and squeezing the lever to check that the brake is functioning properly. If the lever pulls too far to the bar, the system needs re-bleeding. If the pistons aren't returning then the brake needs servicing, so take it to your local dealer (or see the relevant servicing section in this mag). If all is well, continue to the next step.



13 REALIGN AND REINSTALL

Reinstall the brake system to the bike using the hose guides, clips or cable ties. Check the calliper alignment over the disc, check cable route and identify any possible snags or problems. If you wish, add protective tabs to possible wear points on the frame. And again, pump the lever and check the activation of the brake.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

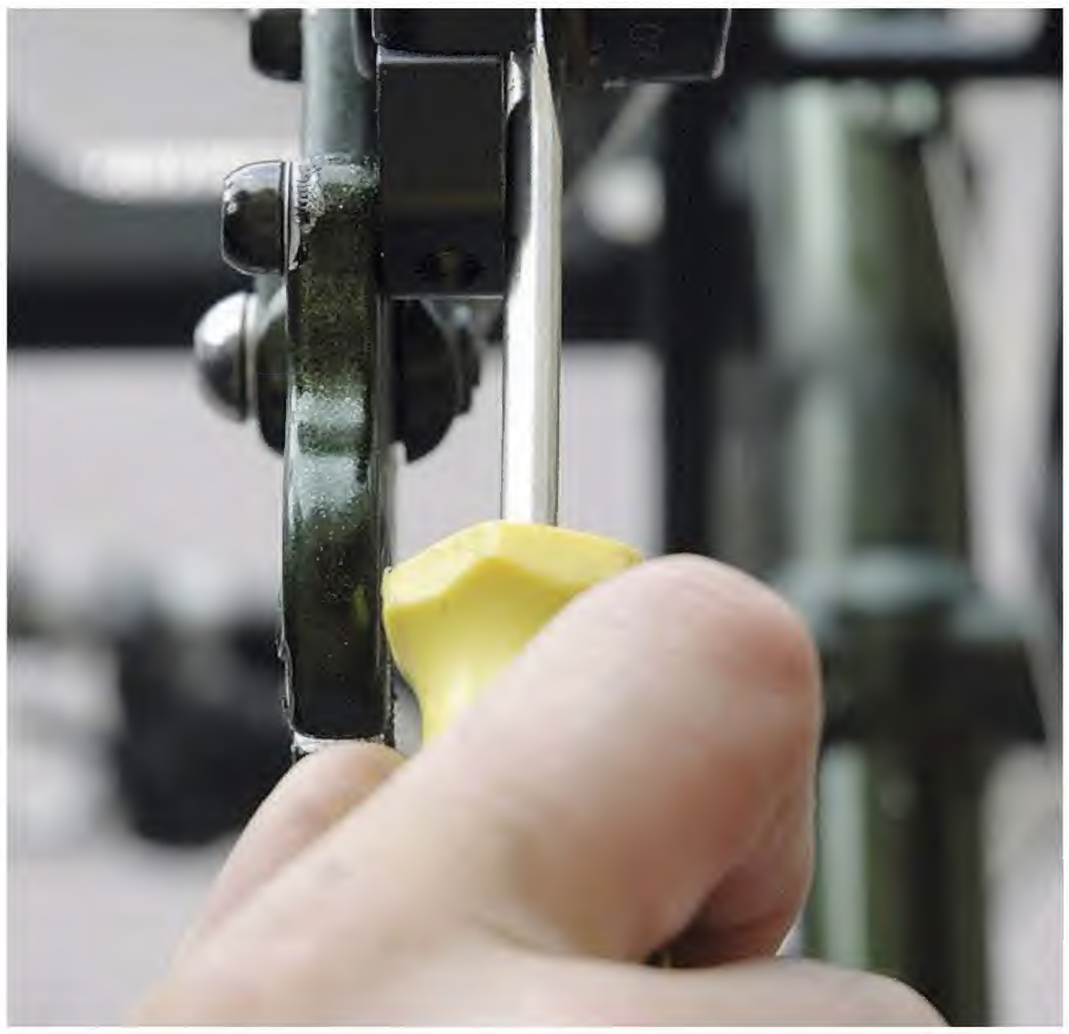
10-30 mins

No more then the price of a zip tie or elastic band

FIT POST MOUNT DISC BRAKES

Here's how to get your PM disc brakes correctly set up for safe braking and smooth running, mile after mile, and without any rubbing and squeaking

Disc brakes come in two main varieties: those that use the International Standard (IS) mounting system developed in 2000, and those with the older Post Mount (PM) system, as used by Hayes. IS brakes are generally heavier and more fiddly to set up, and although IS has been the main standard for some time, the old PM system is fast becoming recognised for its benefits and is being offered by traditionally IS brands, including Shimano and Hope.



3 LOCK THE LEVER ON

Use a zip tie or elastic band secured round the brake lever and bar to pull the lever inwards and push the pads on to the rotor. The pistons in the calliper should be moving an equal distance so that the pads sit evenly and firmly against the rotor.

4 CHECK PISTON GAPS

If the pistons aren't moving an equal distance, the pads might need to be reset. Drop the wheel out of the frame, squeeze the brake lever once so that the pads move together and then check the distance between them. If the rotor is unable to fit between the pads, insert a clean, flat screwdriver head or a proprietary pad tool and gently prise them apart until the gap is sufficient for the rotor to fit without rubbing. If this doesn't cure the problem, it might be because the pistons are sticking, in which case the answer will be to get the calliper serviced by a reputable mechanic.

- ✓ Zip tie or elastic band,
- ✓ Adjustable spanner/ rotor truing tools,
- ✓ Flat-head screwdriver or brake pad separator,
- ✓ 5mm Allen key

WORKSHOP WISDOM

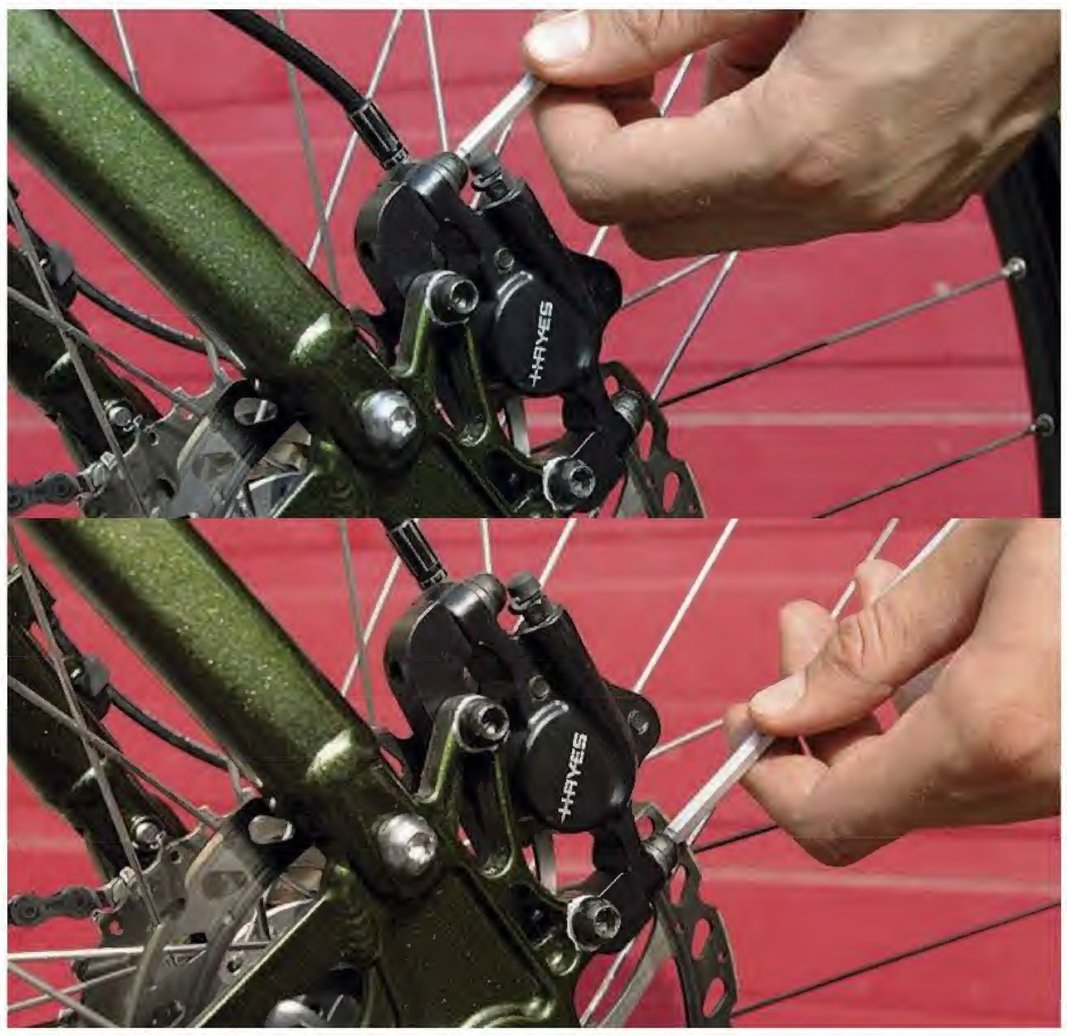
When checking to see if the calliper is properly centred – by looking for an equal amount of daylight between the pads – it's helpful to hold a piece of white paper or card behind the calliper. This makes it easier to see the size of the gaps.

1 FIT IS TO PM ADAPTOR

PM callipers usually incorporate a two-part mount using an IS adaptor to ensure they will fit IS frame and fork tabs. Assuming your bike has IS tabs, you need to fit the IS adaptor to the frame using a 5mm Allen key.

2 SLACKEN CALLIPER BOLTS

Ensure that the frame mounting bolts are tight and then, while holding the calliper on to the adaptor, loosen the calliper bolts a little so that the calliper can freely float from side to side; half a turn of the Allen key will do. If the hydraulic hose is in its chainstay guide, take it out so the calliper can move freely. If you have PM frame tabs, ignore the IS adaptor; remove it, bolt the calliper to the frame and slacken the bolts so the calliper is free-floating.



5 TIGHTEN CALLIPER BOLTS

Centre the calliper over the rotor and then, while holding the calliper on the adaptor or frame, tighten the Allen key bolts bit by bit, alternating between them both. Keep a close eye on the calliper itself to ensure that it doesn't 'walk' off-centre because of friction on the bolts. If this happens you'll need to slacken the bolts off, re-centre the calliper and carefully begin tightening them again.

6 CHECK AND TRUE ROTOR

When the calliper is tight, remove the zip tie from the brake lever and return the hydraulic hose to its guide. Check that the rotor is centred; look for equal amounts of daylight between the rotor and both pads. To check the rotor isn't warped, which could make it rub, spin the wheel.

If it is, gently true it using either disc truing tools or an adjustable spanner. Remember that a little force goes a long way with an adjustable spanner.

ROAD
OFF-ROAD

BEGINNER **EXPERIENCED** EXPERT

40 mins

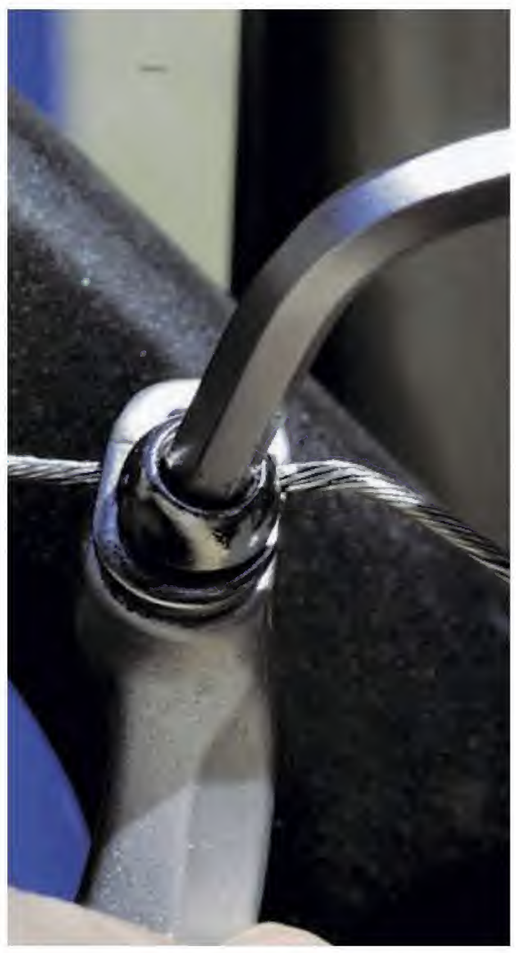
£30-£50, depending on components

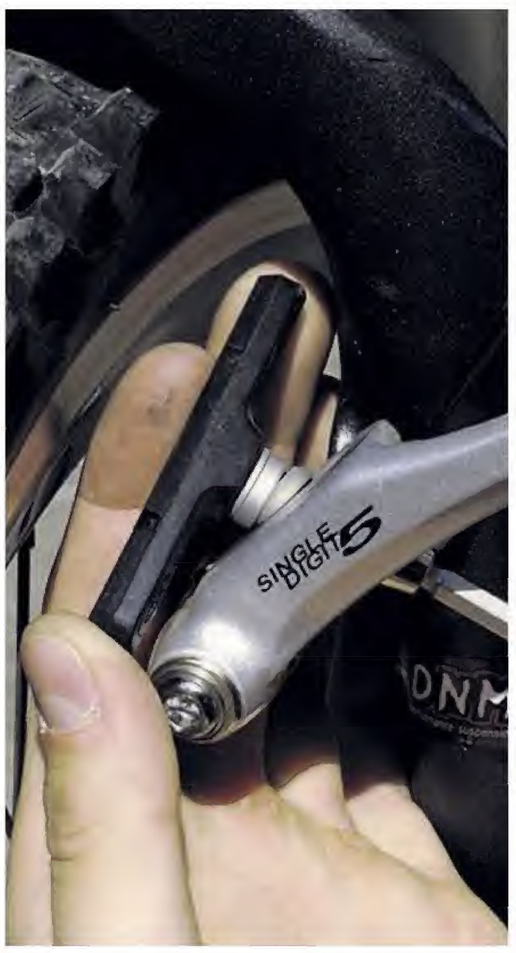
IMPROVING V-BRAKE PERFORMANCE

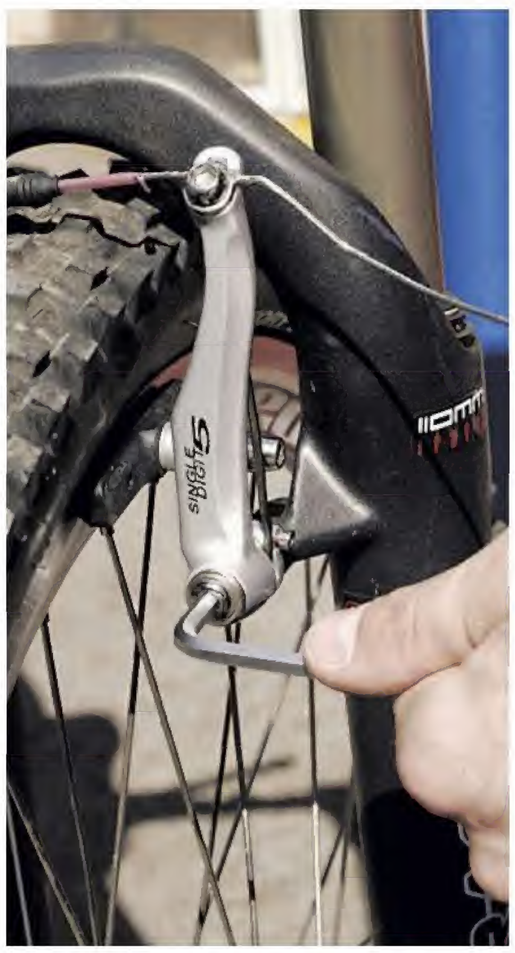
Disc brakes are commonplace, but V-brakes still appear on some bikes and can still perform well if kept in good condition. Here's how to change the blocks and give them a once-over

1 REMOVE OLD BLOCKS

Take note of the position of the shims and washers, as this is important when it comes to replacing them (see step three). Also check the brake cable; if you find any fraying or other damage to the inner cable, you need to replace it. This will improve braking performance dramatically because the new inner will offer little resistance within the outer casing.







5 SECURE THE CABLE

Now pull the brake cable through the clamp on the brake arm so that there's just enough length to hold the pads near the rim. You can adjust and crimp the cable later.

6 LINE UP THE PAD

While holding the brake arm and pad in one hand, and an Allen key in the other, adjust the pad so that it touches the rim evenly when the lever is pulled and doesn't rub on the tyre or foul the spokes.

7 GIVE PADS SOME TOE-IN

Before you tighten them fully, you should add some slight 'toe-in' to the pads. To do this, adjust them so that the front of each one (the end facing the front of the bike) touches the rim slightly before the rear. This pulls the whole pad into contact with the rim and eliminates squealing by stopping the pads vibrating.

8 SECURE THE BOLTS

Now check that both the bolts holding the pads and the bolts holding the brake to the bosses are tight. Make sure that the brake pads don't move when tightening the brake bolts.

- ✓ V-brake pads
- ✓ V-brake inner cable
- ✓ 2, 3 and 5mm Allen keys
- ✓ Small crosshead screwdriver
- ✓ Pliers,
- ✓ thin oil, eg Finish Line XC Lube
- ✓ Good bike cleaner, eg X-Lite Muc-Off
- ✓ Clean rags

2 LUBE CABLE OUTER

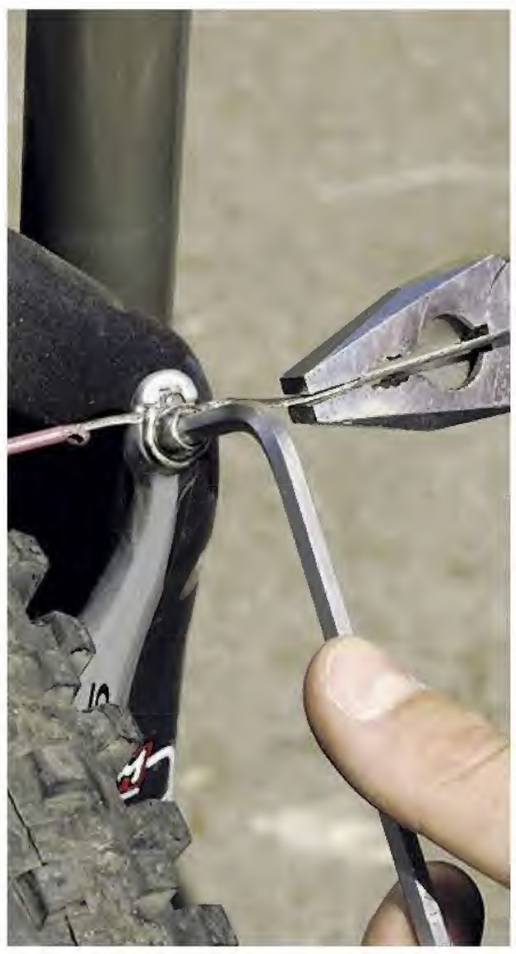
If you need to fit a new inner cable, remove the old inner and spray some lube into the outer cable before sliding in the new inner. Then locate the nipple in the cradle on the brake lever, and screw the barrel adjuster all the way in – this compensates for pad wear in the future. If you want to adjust the reach of the lever, use a 2mm Allen key or crosshead screwdriver (depending on lever type).

3 INSTALL NEW BLOCKS

To attach new brake blocks, push them into the brake arms and add the shims and washers in the order they were in before you removed the old blocks. Then tighten the Allen nut, but leave it loose enough to allow you to adjust the blocks later.

4 CLEAN THE RIM

Using a rag, give the rim a clean, checking for any cracks or deep scores. Make sure that you use a cleaner that doesn't leave any residue on the rim, otherwise you'll have to spend ages getting the brakes to bed in again with little stopping power available as you do.



9 TIGHTEN THE CABLE

Using pliers, pull the brake cable further through the clamp on the brake arm, and tighten the bolt when the cable reaches the desired length. As a general rule, when the brakes are fully applied, the lever should have travelled through approximately one-third of its total range of movement.

10 CENTRE THE ARMS

Finally, use the screws and Allen bolts on the side of the brake arms to centre the arms. Once you've done this, the process is complete and your V-brakes should now be performing at their best.

11 GO FOR A TEST RIDE

After a final check in the workshop, it's time for a test ride. Gradually build up speed, checking lever travel and pad bite. Pay close attention when cornering too; there is more chance of the blocks rubbing under load than on a static bike. Once you're satisfied, let rip. Or even go racing. Our testers have proved that cheaper bikes can hack it.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

60 mins

£10 TO £100 FOR VARIOUS PARTS

REFRESH YOUR WHEELS

Nothing has a greater effect on the performance of your bike than the wheels. Here's how to keep them running at their best and gain speed cheaply

Wheels are the number one target for upgrading on any bike, but they don't come cheap. So, how about spending more time than cash, and refreshing your existing wheels back to their best?

Here we'll show you how to gain a significant advantage by simply sprucing up your tired wheels with a bit of TLC and a modest budget. Whether you have handmade or factory pre-built wheels, some or all of these steps should add up to an improvement in speed and acceleration, especially over longer distances.

If in doubt about your abilities on the more technical steps, get them done by a trusted professional mechanic. Expect to pay about £15 to £20 per wheel for a thorough true, tension and dish adjustment, and about the same per wheel for a hub overhaul, not counting parts.

Money spent on carefully selected lightweight tyres, tubes and tape can also reap big rewards. Check out the panel below to see how much weight can be saved, and then think what it would have cost to cut that mass from the wheels themselves.

Let the good times roll!

1 CLEANER = FASTER

Seeing as the hub is going to be serviced, you don't need to worry too much about getting water into it. After using a bit of Muc-Off, a bucket of warm soapy water and a stiff brush does the trick.
Although many new rims will have built-in wear indicators consisting of either a groove or shallow hole that is meant to disappear when wear limits have been reached (or a small hole that's meant to appear when worn through), if the rims show signs of serious concave wear, you might need to make a more accurate measurement of the wall thickness. Using the technique in the next step, you'll know if the rim needs to be replaced. The rim will be clearly bent outward at high pressures, and look out for any cracks running lengthways.

5 LIGHTER GREASE

The point of this exercise being more speed through lighter weight and less resistance, a good place to gain yet another small but helpful advantage is in the choice of grease used to lube the bearings. Middleburn used to manufacture a wonderful hub that used an oil bath system, but would often leave small puddles. After placing your bearings, you can now dribble a few drops of oil onto the grease; just four or five drops on either side. This will act as a solvent with the grease, making it less sticky, especially in the cold. You may lose a bit of water resistance and grease durability in foul weather, so you'll need to stay on top of your hub maintenance. Give them a frequent check with your fingertips for signs of dryness or roughness.

6 LIGHTER RIM TAPE

Saving about 10g per wheel, this is another great way to increase your results. You'll find that the old rim tape is probably badly worn, split, or possibly doesn't adequately cover the spoke holes and ferrules. This is actually a frequent issue on many new bikes that presents a constant annoyance to cyclists (mystery flats), and diligent shop mechanics (having to replace rim tape with wider stuff on as many as a quarter of all new bikes), with potentially serious consequences. Run a screwdriver or plastic tyre lever underneath the rim tape and get it going in the right direction to fine tune the valve hole alignment. Failure to do so may result in a crooked and damaged valve stem. Make sure it covers the spoke holes adequately, while not interfering with tyre bead seating.

7 LIGHTER TYRES

Just as colour and shape can affect physical performance through their effect on emotion (just imagine walking up to a bright red Ferrari with the keys in your hands, and see if your heart rate doesn't shoot right up), so can sound. These Michelin Pro Race tyres, and others similar to them, can really cut down on rotating mass, with pretty healthy savings of up to 100g over wire bead tyres. Combined with lighter tubes, the reduced wall thickness and higher pressures will also produce an interesting new sound, that of speed:
a hollow, whooshing hum guaranteed to make you want to go as fast as you possibly can! Make sure the tyre bead is evenly positioned around the rim, and check that the tube isn't pinched at the valve stem before inflating to about 110-120psi.

Home truing stand (around £20)
Spoke key (£5–£10)

WEIGHT SAVINGS

Old tyres: 290g each
Old tubes: 130g each
Tape: 25g each
Total: 890g

New tyres: 185g each
New tubes: 50g each
New rim tape:15g each
Total: 500g

Weight saved: 390g (over 0.85lb)
Cost: £88

2 INSPECTION

Once clean, carefully inspect the wheel for any signs of wear and tear, especially braking surfaces and hub flange spoke holes; there's really no point doing all this work only to find your rim is about to fail once the tyre is inflated. You can make your own measuring device by bending a straight gauge 2mm spoke (14-gauge) into a horseshoe shape. Now put a 5-10mm long tab at the end of each 'leg' by bending said amount at a right angle from the plane of the shoe with a pair of pliers. Position the device by pinching the rim flange between the tabs and take an overall measurement with a set of callipers. You should get a measurement of 5mm or more, telling you that the rim wall thickness is at least 1mm or more and safe to use.

3 HUB OVERHAUL

To help you navigate through the hub service, refer to the photo above for common hub internals. Those in the top half are used in Shimano, older freewheel type Campag and most other Taiwan clones; you'll need two 13, 14, 15 and 17mm cone wrenches. The bottom half shows the current Campag set-up which requires two 5mm Allen keys for the end nuts, a 2.5mm for the threaded cone adjuster, and some deft fingertips to keep the pawls in place. Keep everything in the order it was disassembled, and clean with a bit of degreaser and a cloth. Inspect the bearing surfaces for wear and pitting, and replace the cones if damaged. Better bearings and cones will set you back about a tenner per wheel, but it's worth it in the long run.

4 QUALITY BEARINGS

While you've got your hub opened up, you might want to take the opportunity to upgrade the ball bearings to higher quality ones. Better materials (chromoly or even ceramic) and smoother, more finely machined surfaces will add to both the real and psychological advantage. Standard Shimano and pre-redesign Campag hubs take about 10 3/16in balls per side at the front, and nine 1/4in per side at the rear. Beware: Shimano clones will often have 7/32in balls on the freehub side and 1/4in on the left rear. New Campag hubs use plastic bearing retainers with 5/32in balls front and rear, with sealed cartridges in the freehub that usually last a while. If in doubt about numbers, add bearings until they touch, then remove one.

8 TENSION

Check the spoke tension in order to assess the general condition of the wheel, and as a guide when truing: will you want to mainly tighten spokes, loosen, or a combination of both? Go around the wheel, squeezing crossing pairs of spokes on the same side, both left and right. They should feel quite firm, and deflect no more than about 5mm in the middle section of the spoke, and a bit less than that for the drive side rear on 700C wheels with conventional 1.8/2mm spokes. Pluck with a fingernail or tap the spokes with a metal object to listen for an even, high-ish tone all the way around. Or better, use a tension gauge (such as Park Tool's TM1 tension meter), in this case a reading of between 17 and 25 on a Park meter should assure good integrity.

9 WHEEL TRUING

Over a period of time, a wheel can get to the point where it no longer stays put and goes out of true easily. Having assessed the overall tension in the previous step, proceed with a drop of light lubricant on each spoke nipple, and after allowing them to soak for a while, start truing. Spoke nipples are basically nuts with a standard thread direction (right = tight, left = loose; simple). With the wheel upright, work from the top of the rim and proceed no more than a quarter of a turn at a time; tightening a spoke pulls the rim in the direction of the hub flange from which it exits and draws the rim towards the hub. If there are any high or low spots affecting the roundness of the rim when you turn the wheel after tightening a spoke, adjust adjacent spokes to pull it into shape.

10 BALANCING

This next step is the icing on the cake – a well balanced wheel will help give you that little extra something to sweeten your ride to the max. Once you're satisfied that your tyres are correctly installed, the wheels trued and the hubs running freely, assess the wheel balance by simply allowing it to settle from a previous position: the heaviest section will be at the bottom, and will most likely correspond to the valve stem. You can counter-balance this by attaching a short length of lead wire at the opposite end, with two or three zip ties pulled tight (small split fishing-line weights might work too). A tyre valve weighs about 7-10g, so get your scales out to check. The wheel should now settle at random positions without moving.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

60 mins per wheel

£5+ for spoke key

WHEEL CHECK AND TRUE-UP

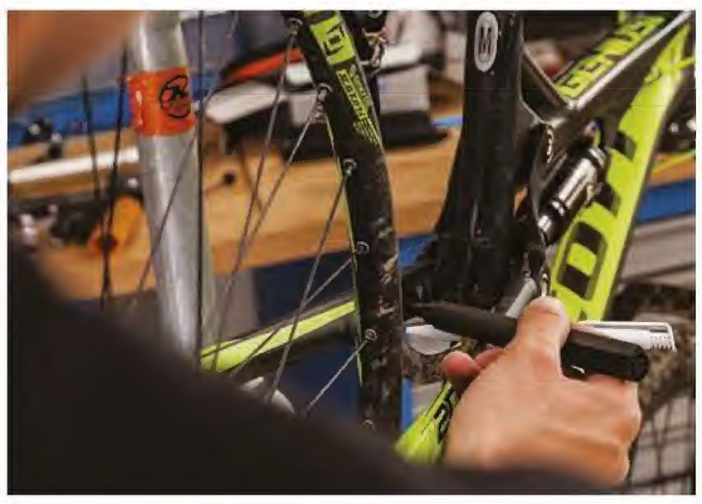
Getting your wheels running straight and true might seem like a dark art but if you take it slowly and methodically, it's not too hard.

1 REMOVE TYRE AND TUBE

To check if a wheel is true, start by turning your bike upside down or clamping it in a workstand. Remove the wheel you're going to work on – in this case, the rear – from the bike. Remove the tyre and tube, then refit the wheel in the frame. Check the spokes are all tensioned by giving each pair a light squeeze between your thumb and forefinger.

5 CHECK FOR BUCKLES

Spin the wheel again. This time you're looking for any sideways buckles in the rim. You can make a gauge that'll help you check for this, using a rubber band and a ballpoint pen or lolly stick. Hold the pen/stick at 90 degrees to the chainstay or seatstay and use the rubber band to secure it in place, making sure it's wrapped tightly around the stay.



6 CHECK ROUNDNESS

Position yourself at the back of the bike, facing the rim bed, and spin the wheel again. Slowly push the pen/stick closer to the wheel until it's lightly touching the rim. This will show you where the rim is off centre. Slow the spin down and use your permanent marker to mark the last spoke before the buckle and the first spoke after the buckle.

7 ADDRESS BUCKLE 1

Add a quarter turn of tension to the spokes attached to the opposite side of the hub to the buckle – so, if the wheel is buckled to the right, you'll need to tighten the spokes that run from the affected area of rim to the left-hand side of the hub. Now run the rim past the pen/stick again.

11 CHECK VERTICAL DAMAGE

Now the wheel has no sideways buckles, it's time to look for vertical deflection. Inspect the wheel slowly, looking for flat spots in the rim. These are caused by big impacts and aren't something you can cure with a true-up. If you find any, mark them with a pen or small sticker to make sure you don't try to cure them in the next few steps.

12 MARK DAMAGE

If you find a high spot, where the rim moves further from the hub, count the number of spokes attached to the affected section of rim, highlight them with your marker pen and tighten them all a quarter turn, making sure you tighten an even number of spokes. Repeat until the high spot has been removed. Repeat with any other high spots.

13 LOOSEN SPOKES

If you find a low spot, where the rim dips closer to the hub, count the number of spokes attached to the affected section of rim, highlight them with your marker pen and loosen them all a quarter turn, making sure you loosen an even number of spokes. Repeat until the low spot has been removed. Repeat with any other low spots.

- ✓ Spoke key (make sure you get the right size/type for your wheels)
- ✓ Ballpoint pen or lolly stick
- ✓ Permanent marker pen (can also use small stickers)
- ✓ Tape measure
- ✓ Rubber band

WORKSHOP WISDOM

Truing wheels is a task that goes from mountain to molehill with practice, but even experienced wheel builders will take their time. Be methodical with every step and use the valve as a reference point so you remember where you're up to on the wheel. Multi-tool spoke keys don't cut the mustard unless it's an emergency. Get yourself a decent workshop spoke key – they're cheap and will last a lifetime. When checking for spoke tension, use another wheel as a reference point and don't go super-tight. Tighter really isn't better, so if you're having to use all your strength to make an adjustment, something probably isn't right.

2 CHECK SPOKE TENSION

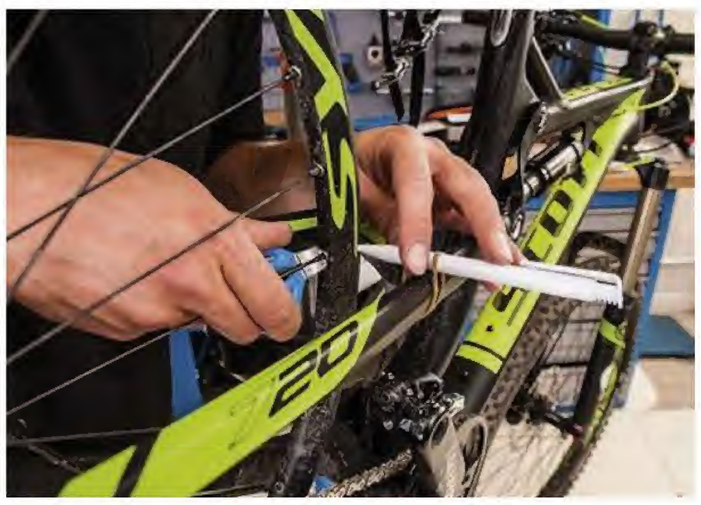
If there are any loose spokes or if they all seem a bit baggy, this is likely to be the root of your problem. If there are single loose spokes, use your spoke key to tighten them half a turn at a time – by turning them clockwise, viewed stood facing the rim bed. Feel for tension every half-turn. When the tension starts to feel similar to the other spokes, stop tightening.

3 TENSION SPOKES

If the spokes all feel a bit baggy, start at the valve and work around the wheel, tightening each one a quarter turn. When you get to the valve again, use your thumb and forefinger to make sure they're all evenly tensioned. If you don't know how tight the spokes should be, compare them to the other wheel (in this case, the front). If they still feel baggy, repeat this step.

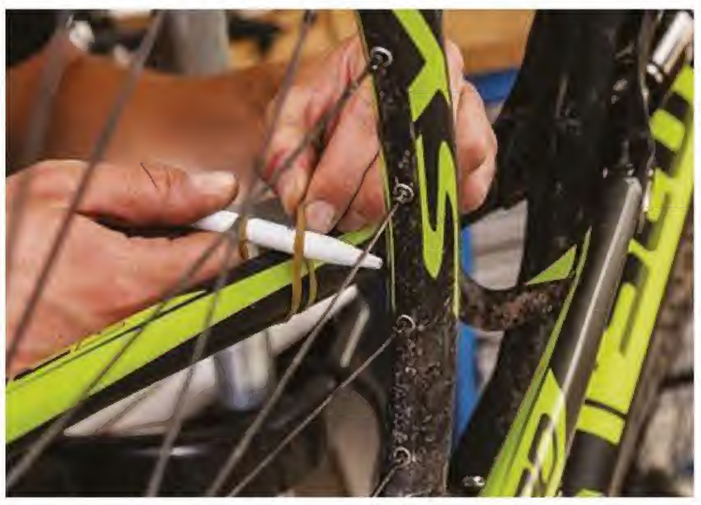
4 CHECK RIM FOR DENTS

Now your spokes are all tensioned, have a look around the rim for any dents, running your finger around the rim wall to be sure. If you find any, highlight them with a permanent marker so you know where they are. Take your time, because these dents will throw you off in the next few steps if you don't allow for them all.



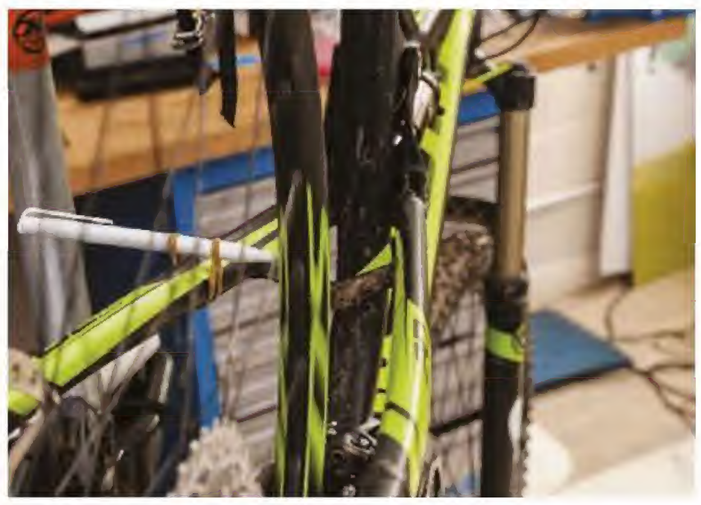
8 ADDRESS BUCKLE 2

If there's still a buckle in the same place, loosen the spokes attached to the same side of the hub as the buckle by a quarter turn. This will release the tension on that side of the rim and help the newly tensioned opposite-side spokes pull it back into line. Repeat steps 7 and 8 until the buckle you're working on is removed.



9 CHECK OPPOSITE SIDE

Work around the wheel, removing every buckle in the same way. Once you've fixed one side, swap your truing gauge to the opposite stay and repeat the process. If there are any buckles where the spokes won't pull the wheel into shape, or that last for over a quarter of the wheel's circumference, you'll probably need a new rim, get some advice from your bike shop.

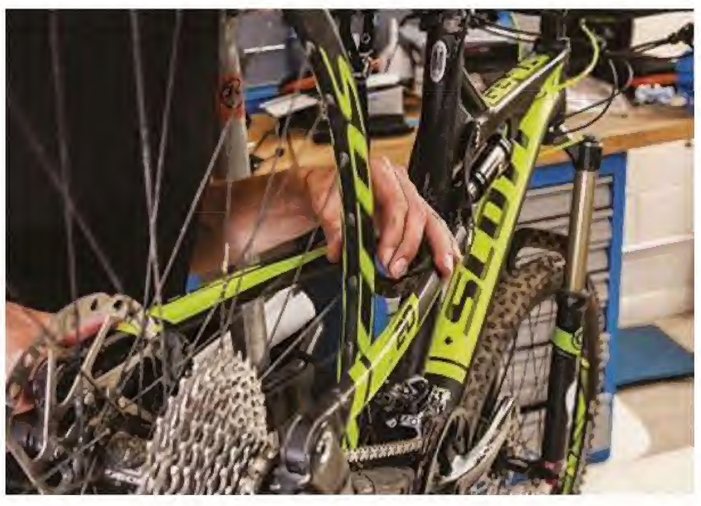


10 CHECK WHEEL IS TRUE

Spin the wheel and use your truing device to check that it's running totally straight and true. Take your time and don't be afraid to keep working at it – this is a real skill. You'll probably need to swap the gauge from side to side a couple of times at least until the wheel is perfectly true.

14 CHECK WHEEL DISH

Now check the wheel runs centrally in the frame, with an equal distance between the rim and each chain/seatstay. If this measurement, called 'dish', isn't equal to within a couple of millimetres, tighten all the spokes attached to the hub on the side with the bigger gap by a quarter turn, then measure again. If the wheel is more than 5mm out of dish, visit your LBS.



15 CHECK WHEEL IS TRUE

Now the wheel has been dished correctly and trued both vertically and laterally, give it a spin again to check it over. Don't expect perfection the first time – the wheel will probably need another lateral true before you're finished, so repeat steps 5-10.

16 POST-RIDE CHECK

After your first ride, get the bike back in the workstand and have another look at the wheel you've worked on. The spokes will bed in after some riding time, so may need adjusting a bit more to keep them perfectly tensioned. Don't forget this step or all your time and effort could go to waste!

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

60 mins

£15-£750 depending on the rim

REPLACING A DAMAGED RIM

A rim that is beyond repair doesn't have to mean the end of the wheel. Here's how to replace the rim while retaining your spokes and hub

1 REPLACE RIM

It's best to replace your rim with a matching model. This will make it easier, and your spoke lengths will be unaffected. If you can't get hold of an identical rim, look for a rim with the same ERD number as your old rim, or one within a couple of mm. If spoke lengths are different, then a straight rim swap won't work – you'd need to rebuild your wheel from scratch.

5 REMOVE TENSION

Continue to loosen the spokes half a turn at a time, removing any tension from them until you can see the spoke's threads, but without removing the nipple. If the nipples are removed it can make the process far more complicated. With the spokes no longer under tension, it's time to start swapping them to the new rim.

6 REMOVE NIPPLE

Next up, starting with the spoke next to the valve hole, use the appropriate nipple driver to remove the nipple completely from the end of the spoke and the rim.

7 MOVE SPOKE

Move the spoke to the neighbouring/equivalent spoke hole in the new rim, popping it through the rim and into the spoke hole. Use the nipple driver to carefully wind the nipple onto the spoke one turn – just enough to get the threads to catch.

11 CHECK TENSION

Work around the wheel, turning each nipple half a turn at a time until the spokes feel roughly as taught as they did at the start. If you have a tension metre, aim for around 120kg/f on each spoke for a 26in wheel.

If you're below this or the spokes feel baggier than they did, adjust all the nipples by another quarter of a turn before re-checking tension.

12 EVEN TENSION

Make sure you're always applying tension evenly. Small adjustments have a big effect on the other spokes' tension throughout the wheel so try to keep adjustments as even as possible. Squeeze each pair of spokes to gauge how even the tension is around the wheel. When you're close to the required tension, it's time to true the wheel.

13 CHECK TRUING

Spin the wheel in the truing stand, and watch for lateral and vertical deflection. Set the truing stand's arms almost against the rim. Ideally, you're looking for less than 1mm of side-to-side or up-and-down movement. If the rim is out of true, you'll need to adjust the tension on the spokes to account for it.

- ✓ Rim tape
- ✓ Spoke key
- ✓ Spoke tension metre
- ✓ Insulation tape
- ✓ Truing stand
- ✓ Appropriate nipple driver
- ✓ Metal rule

WORKSHOP WISDOM

If you're changing the rim on a rear wheel, you'll need to account for the 'dish' of the wheel. The dish is the offset position of the hub in relation to the rim. It's not something you need to worry about with front wheels, but rear wheel rims generally sit off-centre, because they have to accommodate the cassette/freehub. Because of the dish, a wheel's spokes are often a different length on the drive side and non-drive side. When they're equally tensioned though, the wheel should still end up in the right place when you fit it back into the bike. If the dish of the wheel isn't right after the rim swap, you'll need to tension all the right-hand spokes.

2 REMOVE WHEEL

Remove the wheel from the bike, making sure it's clean. Remove the tyre and tube, followed by the rim tape. Clean the rim bed to get rid of any dirt. If you don't have a tension metre, give a pair of spokes a squeeze in order to gauge the sort of tension you'll be working towards later.

3 ALIGN RIMS

Sit the new rim against the old one, lining up each valve hole and rim join, double-checking the spoke holes all line up with each other too. With the two rims aligned, tape them together with four separate lengths of insulating tape. To keep them secure, tape them in the 12, 3, 6 and 9 o'clock positions.

4 LOOSEN SPOKES

Put your wheel with the new rim attached into a wheel truing stand. Grab the spoke key and, working from the valve hole (so you know where you started), turn the key anti-clockwise half a turn, loosening each spoke, one at a time, until you're back to the valve hole where you started.

8 WORK AROUND WHEEL

Work around the wheel from your starting point next to the valve, repeating steps 6 and 7 on every spoke, until you've stripped all the spokes out of the old rim and switched them over to their adjacent holes in the new rim. Remove the wheel from the truing stand and unwind the insulation tape holding the rims together. Discard the old rim.

9 TENSION SPOKES

Stick the newly rimmed wheel back in the truing stand. It's time to tension the spokes. Starting with the spoke next to the valve hole, work your way around the wheel using a spoke key or nipple driver to turn the nipples one whole turn clockwise. Do this for each spoke, once around the wheel.

10 CHECK BAGGINESS

If the spokes are still really baggy, repeat step 9, going around the wheel tightening each nipple by a full turn (roughly until the spoke threads are obscured by the nipples). If the spokes start to feel under tension, work around the wheel again, starting at the valve hole, but only turning the nipples half a turn at a time, this time around.

14 ADJUST

If the rim deflects to the right, you'll need to add a small amount of tension (a quarter of a turn) to the closest opposing spoke (or two) that attaches to the left-hand-side hub flange. You then need to remove tension (quarter of a turn) from the spoke (or two) on the right where the rim deflects. The opposite applies if the rim deflects to the left.

15 RE-CHECK TENSION

With all the adjustments made, re-check the tension in the spokes and remove the wheel from the truing stand. Slot the wheel in the bike. The rim should sit centrally in the fork or between the seatstays. Check the position by measuring either side of the rim. This is the wheel's dish. If the rim sits too far to the left, you'll need to add an eighth of a turn to every spoke on the right.

16 FIT NEW TAPE

Getting the wheel true and the dish correct takes patience. If in doubt, head to your local bike shop for help! If it looks bang on, re-check the spoke tension before removing the wheel and fit some new rim tape followed by the tyre (and tube if you're not running tubeless). Fit the wheel back on and go for a quick spin. Then re-check spoke tensions again.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

1-2 hrs*

Cost of your chosen hubs, rims and spokes

WHEEL BUILDING

Building a wheel is not the dark art it seems. With the right equipment and a bit of patience you can master it. Here we show you how to lace your first wheel

Wheel building may look complex, but if you follow these basic principles you won't go wrong.

Before you start

- A conventional wheel has four groups of spokes; half of the spokes go to the right flange, and half go to the left. On each flange, half are trailing spokes and half are leading spokes. The spoke holes in the rims are offset alternately to each side of the rim. It is vital that the spokes are laced from the hub to the correct side of the rim.
- The hub spoke holes are offset to each other; each spoke hole in one flange is exactly halfway between two holes in the other flange when viewed straight on from the side.
- Spokes cross each other a set number of times unless the wheel is built with the spokes all set radially. Most wheels are built with the spokes crossing each other three times (3X).
- Stainless steel spokes are typical for most applications, especially where more strength is required.
- Spoke diameter is measured by gauge (g) or in mm: 13g is 2.3mm, 14g is 2.0 mm, 15g is 1.8mm, and 16g is 1.6mm.
- Plain gauge spokes are a constant diameter throughout. Double-butted spokes are the most common and thinner in diameter in the middle section eg 14/16g. Single-butted spokes are thicker in diameter at the spoke head end only eg 13/14g and used for heavy duty touring and tandem wheels.
- For improved aerodynamics in road racing and time trialling there are also elliptical spokes, whose centre section is typically something like 2 x 1.6mm, and bladed spokes that are very flat in section, so much so that the spoke holes in the hub have to be specially enlarged sometimes.
- A standard screwdriver can be used to do the initial tightening but a ratchet screwdriver or electric screwdriver will be a bit quicker.
- We show you how to build a 3X 32H rear wheel, but all wheels are built with the same method except for radial spoked wheels and some exotics.

*20-30 mins with experience

4 SECOND SET OF SPOKES, FIRST SIDE

Rotate the hub so that the spoke nearest the valve hole in the rim is pulling in the direction away from the valve hole. Insert a spoke from the outside inwards, in any hole in the same flange. Find the spoke hole in the rim which it just reaches. Count the number of spokes it crosses – it should be three. Lace this new spoke in front of the last spoke it crosses and connect it to the rim. Work your way around the wheel from this spoke fitting the remaining spokes on this side of the hub. Check that your progressing wheel is as pictured above. There should be one spoke hole empty between each spoke.

5 FIRST SPOKE, SECOND SIDE

Sight across the hub from the opposite flange at any spoke. You will see two spoke holes either side of the spoke. The first spoke on the second side of the rim will go through one of these two holes outside inwards. If there is a spoke hole empty in the rim between your spoke and the valve hole insert the spoke through the spoke hole and lace it to the nearest of the two you identified to the valve hole. If there is no spoke hole in the rim between the first spoke and the valve hole, lace the spoke inside out through the other hole to the rim spoke hole immediately the other side of the first spoke.

6 LACING THE REMAINING OUTSIDE INWARDS SPOKES

Lace in the remaining outside inwards spokes; these will need a bit of care as they have to be pushed through the easiest path, which is generally above the last spoke crossing on the opposite flange. The second spoke to go in on this flange goes in outside inwards into the spoke hole, immediately to the right of the first spoke on this side. Sight across the hub; two spokes will be apparent, one of which will be laced the same way, outer inwards. Lace this spoke to the hole in the rim either behind (if your no1 spoke went next to the valve hole) or in front if not. Finally, lace in the

- ✓ Spoke key – good quality that fits Wheel truing jig
- ✓ Dishing gauge
- ✓ Ratchet or electric screwdriver
- ✓ Spokes and spoke nipples,
- ✓ light oil

WORKSHOP WISDOM

We use two terms to describe the way in which spokes are laced into the hub flanges. Inside outwards means that the spokes are laced through from the inside of the flange outwards, so the spoke head ends up on the inside of the flange. Outside inwards means that the spoke is laced through the hub flange from the outside and the spoke head ends up on the outside of the hub flange.

1 PREPARATION

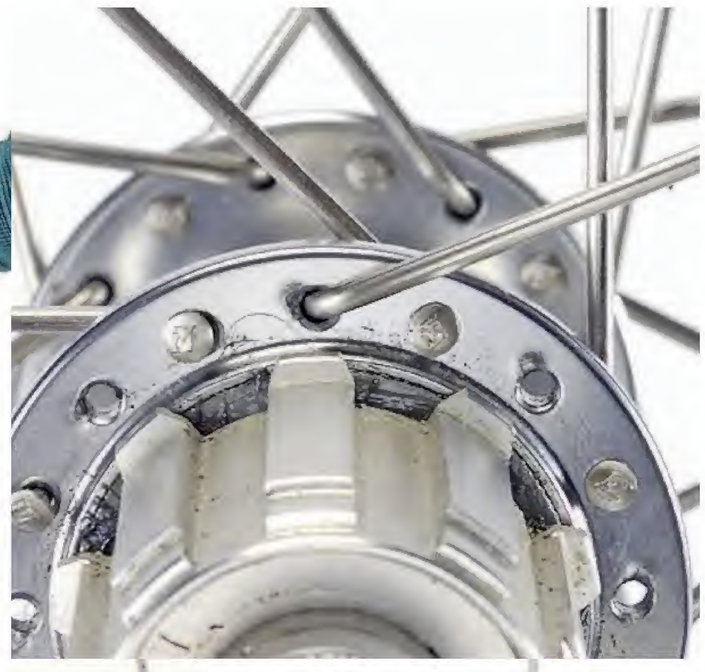
It is critical that the spokes you use are the correct length. Spoke length is measured from the inside of the spoke elbow. There are quite a few spoke calculators on the web. One of the best is www.appliedthought.com/danny/Spoke/SpokeCalculator.html. If you want to use Excel, try www.damonrinard.com/spocalc.htm. Use spokes that are 1mm shorter than calculated for the cassette side of a rear hub and 1mm longer for the opposite side.

2 FIRST SPOKE

First apply a drop of oil to the ferrules or around the inside of the spoke holes in the rim. Insert your first spoke through any hole from inside outwards on the left (nearside) flange of the rear hub or either flange of the front hub. After this, every spoke only has one correct spoke hole. Insert more spokes through alternate holes on the same hub flange inside outwards.

3 FIRST SET OF SPOKES

Lace one of these spokes to the first hole in the rim after the valve hole which is on the same side of the rim as the hub flange. Connect each spoke to the rim every fourth hole and tighten the spoke nipples about three turns. Check that the spacing is even on the hub (every other hole should be empty) and the rim (spoke, three empty holes, spoke etc) all the way around and that the spokes are on the same side of the rim as the flange of the hub.



remaining spokes inside outwards remembering to ensure that they are laced under the spoke at the third crossing in each instance. If you can't get some of the spokes to reach their nipples, make sure that all the nipples are seated properly in their holes.

7 FINAL CHECKS

A correctly built wheel should have the spokes on either side of the valve hole parallel. This makes it easier to get at the valve. All spokes should be woven at their last crossing. The spoke pattern should be symmetrical. Adjust all of the nipples so that each is screwed down equally. Leaving three or four threads exposed is a good start. If necessary, tighten them another turn or two; all should have some tension. All the spokes should have a similar tension except for those on the cassette side of the rear wheel which will already feel a little tighter.

8 IMPROVING THE SPOKE PATH

With your fingers, or a plastic faced hammer, flatten the inside outwards spokes down onto the hub flange and with your hands pull the outside inwards spokes towards the hub flange. This will help the spokes take the best possible line. Then tighten all your spokes by two turns. Your wheel is now ready for truing.

ROAD
OFF-ROAD

BEGINNER

30 mins

£2 for a repair kit
£5 for a new tube

HOW TO FIX A PUNCTURE

Flats are an unavoidable part of cycling. Here's how to repair a punctured tube or fit a new one

1 CLEAN BIKE AND WHEELS

Give your bike a good clean before attempting to fix the puncture. Pay particular attention to the wheel with the flat tyre, making sure you get rid of all the muck. Give the bike a quick wipe down to dry it, then either clamp it in a workstand or flip it upside-down.

5 CHECK INSIDE TYRE

Slowly run your hand around the inside of the tyre, checking for anything that could have penetrated it and caused the puncture. If you come across a thorn or other item of trail debris, use needle-nose pliers to carefully pry it out, making sure there's nothing left stuck in the rubber that could cause another flat. Once removed, continue to check the rest of the tyre.

6 CHECK TUBE FOR DAMAGE

It's now time to inspect the damage to the inner tube and assess whether or not it's repairable. If you plan on fitting a new tube regardless, skip to step 13. Otherwise, inflate the inner tube, ideally using a track pump. Once inflated, you should be able to spot the hole in the tube. If you can't see the hole, hold the tube close to your face and feel/listen for leaking air.

7 LOCATE PUNCTURE

If you still can't locate the hole, fill a bowl with water and slowly pass the tube through it. The leaking air will create bubbles, making the hole easy to spot. If there are two large, parallel holes – known as a 'pinch flat' or 'snakebite' – it's easier just to fit a new tube. If there's a single hole less than 2mm wide, it should be easy to fix.

TIP
Always make sure the patch is stuck down firmly before refitting the tube in the tyre and be careful if you're using tyre levers because it's easy to accidentally pinch the tube with them.

11 CHECK PATCH IS SECURE

Hold the tube between your thumbs and forefingers, with your thumbs on the paper patch backing. Pull your thumbs away from each other to create a tear in the paper backing. Peel the torn paper backing off the patch from the centre outwards, making sure the patch stays stuck firmly in place.

TIP
The more often you remove and refit tyres, the more likely you'll be able to do it without tyre levers. The technique is complicated to describe but intuitive if you're doing the task a lot!

12 RUB WITH CHALK

Attach your pump and partially inflate the tube. Dunk the patched area in the washing-up bowl full of water and watch for bubbles. If there aren't any, the tube is ready to be fitted. Remove it from the water and dry it. Grate some chalk from the repair kit all over and around the patched area of tube to prevent it sticking to the inside of the tyre.

13 REPLACE TYRE

Check the tyre for debris one last time. Slot the valve stem of the tube back through the valve hole in the rim bed and sit the tube back inside the tyre. Starting opposite the valve, use both hands to fold the tyre bead over and into the rim. Work your way around the rim, moving your hands in opposite directions and making sure not to pinch the tube in the process.

- ✓ Pump (a track pump is best)
- ✓ Marker pen
- ✓ Needle-nose pliers
- ✓ Allen key set
- ✓ Tyre levers
- ✓ Puncture repair kit (containing patches, glue, sandpaper, chalk)
- ✓ Washing-up bowl

WORKSHOP WISDOM

A puncture repair kit is a great way to keep old tubes going, but it's best to carry a spare tube with you on rides. That way you can repair the punctured tube later, in comfort at home, rather than at the trailside in howling winds and driving rain – we're in the UK remember!

2 INSPECT FOR DAMAGE

Rotate the wheel in the frame/fork and inspect the tyre for damage. If you find any, note where it is in relation to the tyre. Remove the wheel, replacing the axle in the frame/fork. Deflate the tube by pressing the valve core down with a 3mm Allen key (Schrader/car type valve) or turning it anticlockwise and pressing it down with your finger (Presta valve).

3 PUSH BEAD FROM RIM

Facing the wheel side on, rotate it, pushing the closest bead (lower edge) of the tyre into the centre of the rim bed with your fingers as you go. Hook a tyre lever over the rim and under the bead and use it to lever the tyre upwards and over the sidewall of the rim. Then hook the looped end of the lever over the closest spoke. Position a second tyre lever 50mm from the first.

4 REMOVE TYRE AND TUBE

Unhook the first lever and reposition it 50mm further on from the second lever. Continue working your way around the wheel, one lever at a time, until one side of the tyre is completely removed from the rim and you can see the inner tube. Find the inner tube valve and pop it out of the rim and tyre. Remove the rest of the tube from the tyre.

8 PREPARE TUBE

Draw an 'X' over the hole with a marker pen to make it easy to locate. Then use the sandpaper from your puncture repair kit to lightly roughen up the affected area. It's worth sanding an area that's a little bigger than the patch you're going to use for the repair. Make sure you don't roughen up the tube so much that you wear off your mark though.

9 APPLY GLUE TO TUBE

Coat the sandpapered area with glue from your puncture repair kit. A thin, even coating is all you need. Hang the tube somewhere dust-free to wait for the glue to become tacky (not dry!). This should only take a minute or two. While waiting, pick a suitably sized repair patch and remove the foil backing, leaving the paper covering on the opposite side attached.

10 FIX PATCH TO TUBE

With the glue now tacky/sticky, place the patch centrally over the mark you made on the tube, ensuring you cover the hole completely. Make sure it's stuck down evenly, using the rounded back of one of the tyre levers to press it down, working from the centre of the patch outwards to the edges. Now it's time to remove the paper patch backing.

14 REINFLATE TYRE

You may find there's a small section of tyre near the valve stem where the bead is too tight to seat by hand. If so, hold one end of the unseated section of bead in place with your hand (to prevent it coming out of the rim further) and at the other end of the unseated section. Use a tyre lever to hook the bead into the rim, being careful not to pinch the tube.

15 CHECK SEATING

When the tyre is back on the rim, double check the valve area to ensure the bead is correctly seated. You may need to manipulate the valve gently until the bead sits snuggly around it. Working your way around the tyre, push the bead into the centre of the rim. Then attach your pump to begin inflating the tube.

16 CHECK PRESSURE

Keep a careful eye on the tyre bead as you're adding pressure to make sure it's seating evenly and not bulging anywhere. Once the tyre is at your desired pressure, do another visual check to make sure the bead is correctly in place before fitting the wheel back on your bike.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

60 mins

£40 -£50 for tubeless kit and fluid

CONVERTING WHEELS TO TUBELESS

If you want to go tubeless, you don't necessarily need special rims or tyres. This is how to convert your standard kit relatively easily

1 STRIP DOWN WHEELS

First, take your wheels off your bike's frame, then strip off the existing tyres and inner tubes. If your wheels are old and a bit greasy or dirty, give them a clean either with some hot soapy water or a bit of alcohol. You need the seal between the rubber rim strip and the rim spoke bed to be clean, tight and free from any residue or debris.

5 MAKE THE VALVE AIRTIGHT

You must ensure that the valve itself is airtight. Most brands supply a special threaded locking washer that screws down onto the body of the Presta valve. Normally there's a rubber O-ring which goes over the valve before the locking washer. The act of squashing the O-ring helps form an external seal, locking the air in.

6 CHECK TENSION

The rubber rim strip is now on and it may look central, but you need to check that the strip has gone on with even tension all the way around the rim. If there are loose and tight spots in the rim strip where it has been stretched, it's likely that air may be able to escape between the rim and the rim strip. Use the screwdriver (as before) to go around the rim, to even up the tension. It may take a few minutes.

7 FIT FIRST SIDE OF TYRE

The first side of the tyre has to go on. Tyres vary in fit, quality and detail between manufacturers, and even between models from the same manufacturer. This means some will fit better than others. If yours have been folded for a while, we recommend that you fit them with tubes, pump them up hard and leave them overnight. They'll fit and inflate more easily the next day.

11 REFIT VALVE CORE

With the tyre sealant successfully injected through the valve, it's time to refit the valve core. We recommend applying a small smear of Vaseline on the threads of the valve core first, before screwing it firmly back into position. This will stop any sealant on the threads inside the valve from jamming the core in the future.

12 ALTERNATIVE WAY TO ADD SEALANT

If you're not injecting the sealant through the valve, leave a section of tyre bead off the rim and pour the sealant in before popping the last bit of the bead on. If you're adding sealant between the tyre and rim, carefully pour or use a nozzle applicator to squirt it in as latex makes a mess. When you've got it in, be careful not to let the fluid slop out of the unseated section of tyre.

13 FIT LAST SECTION OF TYRE

To fit the last section of the tyre, you need to carefully move the wheel so the unseated section is at the top of the wheel. As you do this, you will have to allow the liquid to make its way around to the other end of the wheel. Don't worry if a little bit seeps out of the join between the rim and tyre. Use your thumbs to carefully yet forcefully pop the final section of tyre into position.

- ✓ Rim sealing strip
- ✓ Track pump, Airshot or similar
- ✓ Tyre sealant
- ✓ Screwdriver
- ✓ Goggles

WORKSHOP WISDOM

If you get a tyre that just won't seat with your track pump and you don't have a Airshot, Flash Charger or similar system, take the wheel to your friendly local bike shop and ask if they'll let you have a blast of air from their compressor. It should inflate and seat the tyre in an instant.

2 CHECK RIM STRIP

Take the rim strip, unwrap it and turn it so the valve is on the inside face of the strip. Run your fingers around it to check that it doesn't have any cuts, nicks, bumps or moulding imperfections that could give air a chance to leak out. Even a few psi leaking out each day can be very annoying to keep topping up.

3 INSERT VALVE

Present the section of the rim strip with the valve into the spoke bed, carefully poking the end of the valve through the valve hole and pulling this into position. The section of strip by the valve may be a bit thicker and awkward to seat, but persevere as it's worth getting it right now to avoid having to find the source of leaks later on.

4 SEAT RIM STRIP

Next you need to seat the rest of the rubber rim strip to the spoke bed. This is easier said than done, because they're usually quite a tight fit. One of the easiest ways is to get a screwdriver with a long, thin shaft and place the shaft between the rim and the rim strip, with the screwdriver perpendicular to the rim. Run the screwdriver shaft around the rim circumference slowly and help move the rubber strip evenly into the centre of the spoke bed.

8 FIT SECOND SIDE OF TYRE

Seat the second side of the tyre. It's important to stand the wheel at your toes with the valve at the uppermost (12 o'clock) point of the wheel. Take the bead and seat it around the valve, then work your hands around the circumference of the tyre (away from each other), easing the bead over the sidewall of the rim as you go. As you get to the bottom of the wheel, leave an eight-inch section unfitted.

TIP

Shake the sealant bottle really well before you use it. This will help to evenly distribute the fibres that settle in the bottom. Often it's these little bits that do the sealing.

9 REMOVE VALVE CORE

If you're fitting sealant through the valve, you'll need to remove the valve core first. You can get sealants that can be applied with the core in place (Sludge is one), but most won't. Unscrew the core, take it out and don't lose it. If you're doing this in the kitchen and lose the valve core, it'll be under the fridge, guaranteed.

10 INJECT SEALANT

With the tyre fully fitted and the valve core removed, you can use your sealant applicator with the narrow pointed nozzle to inject the required amount of sealant directly into the tyre. Before you do this, though, give your bottle of sealant fluid a really good shake.

TIP

If you're having trouble getting your tubeless tyre to inflate, try unscrewing and removing the valve core before reattaching the track pump chuck. You should find the air goes into the tyre much more quickly, providing the pressure needed to seat the tyre. Once it's seated, remove the pump, reinsert the valve core and top up the pressure to suit your requirements.

14 PUMP UP TYRE

Attach your track pump, begin to pump and – if you're lucky – the tyre beads will push to the rim. A useful addition to your tubeless armoury is a dedicated tubeless inflator like the Airshot or Bontrager Flash Charger – they make initial tyre set up a lot easier. When you've got the pressure high enough (it can take 80psi or so to fully seat UST and tubeless-ready tyres) the tyre beads will 'pop' into place with some loud 'ping' sounds.

15 SHAKE THE WHEEL

There may still be air escaping between the rim and the tyre. Pick up the wheel, hold it by the tyre and hold it flat out in front of you like a tea tray. Shake the wheel vigorously to get sealant to the sides of the tyre, so that it can react with the air and make a thick, air-tight seal. You may find that time helps, too. Leave the wheel for 15 minutes, come back and repeat the step and you should find the air loss has stopped.

16 LISTEN CAREFULLY

Lifting the wheel to your ear and having a good listen should help pick up the sound of air escaping. If you detect any leakage, it should only be from pinprick-sized leaks. Repeat stage 15 and/or try adding a little more fluid. You might find that there is a critical volume of sealant required to complete the job.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

UP TO 2 HRS

Degreaser £5, Grease £5,
New bearings approx £5-60

SERVICE YOUR HUBS

Neglected hubs will deteriorate faster the longer they are left to crunch and rumble. Sort them out now with a thorough service for many more smooth happy miles

A badly deteriorated hub will rumble and crunch as you ride, and will feel worse with your weight on the bike compared to spinning the wheel off the ground. If this sounds familiar, then it's time to show your hubs some love.

Spin the wheel with a finger or two on the fork tip. If the hubs are suffering then it will feel rough and nasty. A full service is in order. Here we talk you through the two main types: standard cup and cone (with loose balls), and sealed cartridge type. A set of balls and cones costs about £5 to £10, while cartridges cost somewhere in the region of £5 to £15 each.

If your cup and cone hubs have really gone through the grinder with months of hard use long after they were due a rebuild, then it's likely that the cups will be pitted beyond any serviceable point. This is where is gets painful, as you will need to replace the hub and that means replacing the whole wheel unless you have high end rims that are worth rebuilding. Take heed now and avoid an expensive lesson later on.

1 STANDARD HUB

Remove the adjuster nut on the skewer and lay the wheel flat with the exposed thread pointing up. Apply a shot of penetrating fluid and let it soak for a while. Repeat a few times, then reinstall the nut and give it a firm whack with a nylon mallet. This should free it enough to move the wheel past the safety tabs. Now spray some fluid in the other side and work the skewer back and forth with the mallet until you can yank it out by hand. Slip a 13mm cone wrench behind the locknut then, using the correct spanner, position yourself safely and then loosen anti-clockwise.

5 JUST A HAIR, PLEASE

The axle should turn freely, without significant play. A bit is good, though, because the quick release clamping force adds load to the bearings. Start by tightening the locknut firmly against the cone on one side of the axle. You'll be fine-tuning with the other side. Bring the movable cone finger-tight against the bearings, then the locknut. Hold the cone and tighten the locknut firmly with the 15 or 17mm wrench. Test this, and if it's too tight back off the cones with two 13mm spanners while forcing the locknuts tight, creating some play.

6 CARTRIDGE HUB

The axle will probably have at least one end with a removable dropout guide/locknut, which you'll need to take off. In most cases, this can be done by inserting a 5mm Allen key at both ends and turning anticlockwise. You might have to put some muscle into it, so use a little cheater bar or long keys for this. Keep track of any washers and their positions between the spacers and axle. The silver spacer doubles as both dust cap and decorative element in most hubs. It might take some strength to pry off; it will likely be held by a rubber O-ring between it and a groove on the axle. Alternatively, some hubs (Mavic) have a threaded cap to allow for bearing adjustment, so just unscrew these first.

7 EXTRACT THE BEARINGS

In order to remove the cartridge, you'll first need to support the hub in such a way that you won't damage it. For example, you could use a delrin tube of the sort you can pick up from www.hopetech.com. You'll need to strike a few sharp blows to get the cartridge out, so a rubber mallet probably won't do; a resin mallet or a hardwood block with a lump hammer are much better at delivering the force necessary to dislodge it. It's also important to avoid whacking your axle from the side without buttressing the hub using the special tool for the job (as shown on the far left of the image above) so as not to damage your axle and spokes.

- ✓ 13, 14, 15, 16mm cone spanners
- ✓ Open-ended 15mm spanner
- ✓ 5mm Allen keys
- ✓ Solid rear axle
- ✓ Nylon mallet
- ✓ Small screwdriver
- ✓ Degreaser
- ✓ Bearing grease
- ✓ Special tools or a suitable size alloy tube to press the bearings

2 GET OUT THE GUTS

Carefully pull out the axle assembly over a cloth to catch any stray parts or bearings. You'll probably want to remove the dust caps to make access to the cups easier for cleaning purposes. This might be a little tricky, as it requires you to gently pry them off using a blunt screwdriver or tyre lever, applying gentle pressure around the inside of the cap. Sometimes they're deformed in this process, which means they become more difficult to fit. If they prove really stubborn and you don't want to risk damage, you can just work around them.

3 OUT WITH THE ROUGH

Remove the bearings with a small screwdriver and clean them for inspection. You should spot any damaged or pitted balls and cones. As the quick release tightens, it compresses the cones and bearings beyond their ideal adjustment, which causes premature wear and pitting. These tiny potholes or irregularities are the cause of a noisy hub. If you notice cratering in the cups, you'll need a new hub, which usually means a new wheel: it's only when you have a high quality rim that it's worth rebuilding. Ask your local shop for advice.

4 IN WITH THE SMOOTH

Clean and flush out the cups with a spray degreaser, or a bit of white spirit or citrus degreaser. Wipe and dry everything. Now put a dollop of new grease in the cups, enough to hold the bearings in place while handling the wheel. If you're unsure of the quantity to use, (usually 10 or 11 3/16in bearings), just fill the entire cup until they touch, then remove one. After installing the bearings, reverse the removal procedure: gently tap the dust caps back in and reinsert the axle assembly, being careful not to dislodge the bearings.

8 CATCH MY DRIFT?

The next operation removes the bearing left behind. Flip the wheel over and position the hub with the bearing facing down. Make sure the hub is sufficiently supported by the flange and there's room for the bearing to come out. Carefully position either the axle or a suitable drift tool (an aluminium tube or even an old solid axle with a cone or nut threaded partially onto it) and knock the bearing out with a few sharp blows. Be aware that you might have to hit it pretty hard if it's a tight fit. Clean with degreaser and a rag, including the hub flanges around the spoke anchor points, and inspect for cracks or corrosion. You'll need a new hub or wheel if cracks are spotted.

9 INSERT NEW BEARINGS

Spread a light coating of grease or oil on the contact surfaces (the outside and inside of the new cartridges, the hub bearing cup and the axle). If the grease is too thick between the bearing and the hub, it could prevent it seating completely. The new bearing should only be driven using the outer race. Use the old bearing or a socket of exactly the same diameter. Keep in mind that the bearing races are made of hardened steel and are therefore potentially brittle. Wear protective goggles and make sure the contact area between the drift edge and the outer race edge is maximised by being perfectly aligned. You'll know the bearing is seated when the blows suddenly firm up.

10 GENTLE TAPS

With the first bearing side down, slide in the axle from the inside. Position the second cartridge on top and using the appropriate drift tool, drive it in with a few careful mallet or hammer blows. Don't allow the bearing to go in askew. Attempting to force it in if it's badly out of line will only get it jammed and make it harder to install, creating ridges that could prevent it seating correctly. Thread the dust caps or slide spacers back on with a little oil, then feel for buttery smoothness. If it's tight, strike a couple of blows on the opposite end (the end inserted first into hub). This should balance out the bearing load and smooth it out. Ride on, brothers and sisters!

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

45 mins

About £40

REPLACING REAR HOPE PRO II MAIN BEARINGS

Hope hubs are superb and their supplied bearings grade A quality, but jet washing and filthy weather can wear them out. Here's how to breathe life back into your hubs

1 WHIP OUT THE WHEEL

There's no need for a workstand with this job, because we're concentrating solely on the rear wheel. So spin the bike upside down, shift the rear gear into the smallest sprocket at the back and remove the wheel.

5 POP OFF SEAL

The cassette body is held in place by the seal. To remove it, grab it tightly, rotate it anti-clockwise and pull it hard at the same time – it should pop out. Take the washer that sits on the axle between the cassette body and the hub body off at this point and put it to one side with the end-spacers.

6 KNOCK OUT AXLE

Now to remove the axle. You need to knock it through from the drive side, out of the disc side. Rest the hub body against a couple of pieces of wood (or onto tool HTT167) with the disc flange supported, take your soft hammer and tap sharply down on the end of the axle. This will drive the axle out along with the disc-side bearing and seal.

7 REMOVE DISC-SIDE

Now remove the disc-side bearing from the axle. Place the assembly into your vice, with the long end of the axle pointing down. The bearing needs to be supported by the jaws of the vice, but nothing clamped up. Grab your soft hammer again and sharply tap the end of the axle to drive it through the bearing.

TIP
If the hub binds when you reassemble it, the chances are you've missed the small spacer behind the cassette body.

11 SEAL UP THE HUB

To fit the disc-side seal, smear some methylated spirits onto the outside of a seal – this helps lubricate it so it seats correctly and then evaporates after a few minutes. Fitting it with grease would lubricate the seal and allow it to push out when fitting the spacer, causing the hub to drag, so just use meths and wait for it to dry.

12 GREASE UP HUB

Place the small washer onto the drive-side of the axle. Take your cassette body and smear a little Teflon grease around the inside of the ratchet in the hub body. Make sure that it's just enough to fill the ramps of the ratchet, as using too much will stop the pawls from engaging correctly and can cause premature wear and slipping of the pawls.

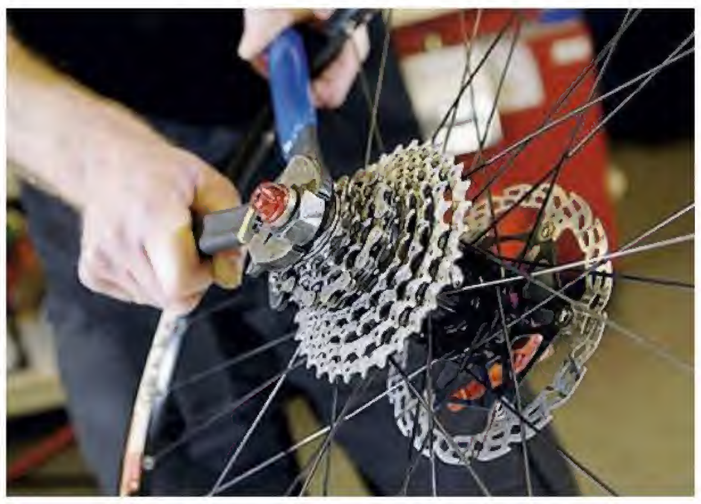
13 REFIT CASSETTE BODY

Now ensure there's a small amount of grease smeared onto the spring seated in the freehub where they touch the pawls. To refit the cassette body, rotate it anti-clockwise while pushing in gently and then reseat the seal, using tool HTT175. Make sure the seal is centralised, then slip the tool over the cassette body and with a sharp push, the seal will snap into place.

- ✓ Soft hammer
- ✓ Vice
- ✓ Teflon grease
- ✓ Methylated spirits
- ✓ Seal tool HT175
- ✓ Hub bearing tool HTT174 (obligatory)
- ✓ 2 x 61903RS bearings
- ✓ Disc-side seal
- ✓ Cassette body seal tool HTT175
- ✓ Torque wrench
- ✓ Wooden blocks
- ✓ T-25 Torx key

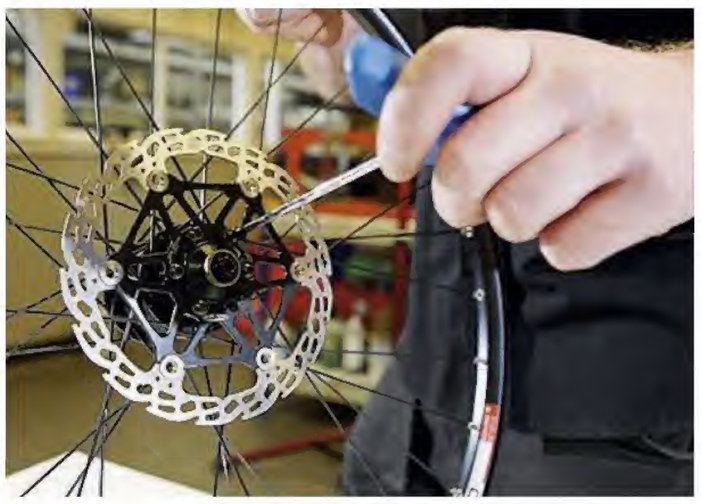
WORKSHOP WISDOM

Don't cut corners. You really do need to buy the bearing installation tools, or you'll damage the new bearings when fitting them, negating all your hard work and costing you more.



2 REMOVE CASSETTE

Unscrew the skewer nut, but leave the skewer in place and put the lockring tool into the lockring. Now screw the nut back on to hold it in place. With the cassette facing outwards, place the chainwhip around the sprockets so that it's in your left hand, put the adjustable spanner onto the lock ring tool and push down to crack it undone. Remove the skewer nut and the lockring fully then withdraw the cassette.

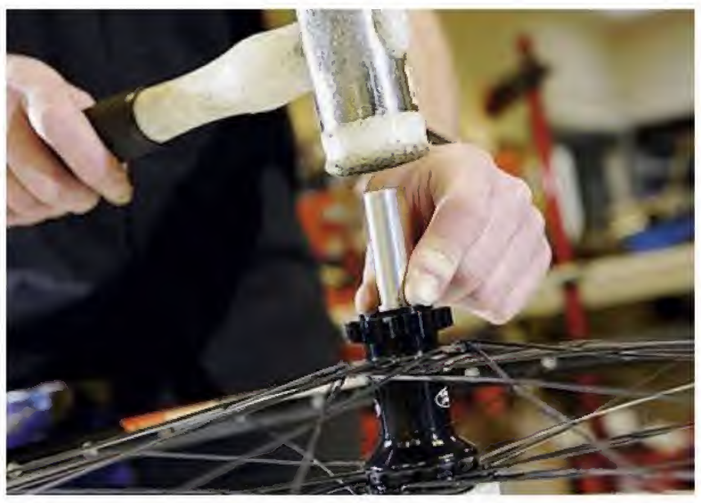


3 REMOVE ROTOR

We recommend that you remove the disc rotor too, because there's going to be grease and all sorts flying around, which won't do it any good. Removing it stops it getting damaged. Grab your T-25 Torx key and remove all six bolts.

4 WIGGLE OFF END-SPACERS

The aluminium end-spacers are held in place by O-rings. To remove them, clamp them lightly in a vice, preferably one with soft jaws. Pull and wiggle the hub to 'walk' them off.



8 AND DRIVE-SIDE BEARING

You can now use your axle to drive the remaining bearing out of the hub. Grab the wheel and rest the drive-side spoke flanges against the blocks of wood (or against tool HTT167). Drop the shorter end section of the axle down into the hub and drive the axle through and out using your soft hammer. You then need to remove that bearing from the axle as per step 7.

TIP

Don't scrimp on replacement bearings. You get what you pay for. Genuine Hope replacement bearings are the best.

9 OLD BEARINGS FOR NEW

Time to fit the new bits. Smear a little grease onto the inner surface of the hub body where the bearing fits, which should help it slide into place. Grab the wheel and rest it on top of your blocks of wood with the disc flange supported (or against tool HTT167). Drop the first bearing into the drive side and, using tool HTT174 against the bearing, sharply tap it into place with your soft hammer.

10 REPLACE AXLE

Leave tool HTT174 in place, flip the wheel over and rest it on a hard surface, such as a floor without carpet. Grab your axle and put the long end section into the hub. Then get your bearing, drop that over the other end of the axle and roughly seat it into the hub. Now put tool HTT174 against the bearing and drive it sharply into place using your soft hammer.

14 SLIDE SPACERS BACK ON

Refit the axle spacers. Put a little smear of grease onto the axle stubs to aid sliding them on, and also put a smear onto the contact surface of the seal but don't fill it as this will push the seal out when fitting the spacer. Then slide the spacers into place.

15 FINAL ASSEMBLY

Now refit the cassette. Put a smear of Teflon grease onto the splines first, slide your sprockets on and tighten the lock ring to 34Nm. Wash your hands to get rid of any grease you have on them, grab your disc rotor and refit that, checking its orientation, and tighten the rotor bolts to 3-6Nm.

16 GET READY TO RIDE

Finally, put the wheel back in the bike, flip the bike the right way up, pat yourself on the back, make a cup of tea and look forward to rumble- and squeak-free super-smooth riding!

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

40-90 mins

Price of a new fork

FITTING A NEW FORK

Installing a fork is a relatively simple procedure, and knowing how to drop out and refit a fork is an essential skill for inspecting and servicing the headset. Here's how

1 SUPPORT AND PREPARE

To remove the outgoing set of forks, place the bike into a workstand by clamping via the seatpost and then drop the front wheel out of the forks. Remove the disc brake calliper from the fork using the correct Allen key and remember to keep everything together and in the order you removed them to make reassembly easier.

5 REMOVE LOWER RACE

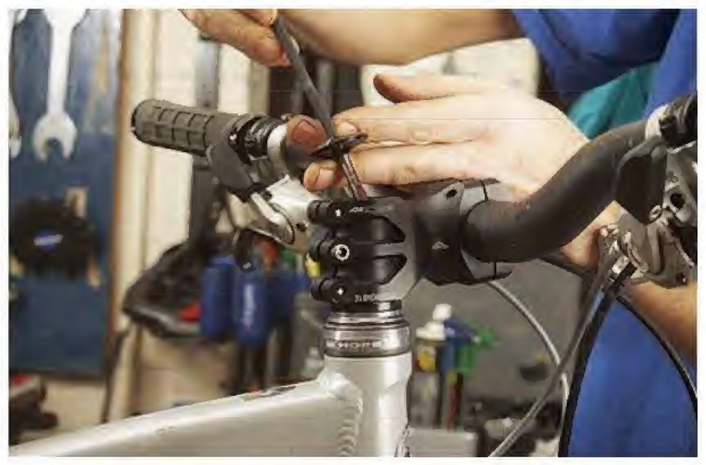
As you'll hopefully be using your existing headset, you will need to lever off the lower headset race from the old fork. Do this using a large, flat-bladed screwdriver and a hammer. Tap the race from beneath and work around its circumference until it can be easily slid off the steerer. Some forks have a recess that allows access under the race to make this process easier.

6 REFIT LOWER RACE

Take your new fork and press the lower headset race into position. Some headset manufacturers – like Cane Creek – use a split race to allow it to be easily pushed into position by hand. Others need to be pressed in using a dedicated crown race installer. This is a job for a bike shop if you don't fancy buying the tool or you can improvise one using an old lower headset stack and bearing race.

7 MEASURE AND MARK

Measure the head-tube length plus the headset stack height, including the upper and lower bearing races and the compression ring. Add the height of the stem clamp and any spacers then subtract 3mm – this is the length you should cut your new fork's steerer tube to. Double-check this by assembling everything into the frame and marking around the stem top. Disassemble, then mark the cut line 3mm below the original mark.



11 DRIVE IT HOME

Place the tool onto the steerer then, holding it in a straight line with the steerer, hit the tool home with a hammer. As the nut descends, the guide will keep it straight. Keep hitting the tool to drive the nut into the steerer until the tool comes to a stop, indicating that the nut is home. Now you can unscrew the tool.

12 GREASE AND ASSEMBLE

Place the lower headset bearing and hardware onto the fork crown race. Grease the fork then slot it up and through the head-tube, making sure the gear and brake lines don't get caught behind the fork. Grease and assemble upper headset hardware and compression ring on the steerer. Firmly seat the fork and headset bearings by lifting the fork up from below the head-tube and seat the upper hardware by hand.

13 REFIT STEM AND SPACERS

Replace the headset seal and cover, then slide on any spacers. With the brake and gear lines routed properly, slide the stem onto the steerer. You'll need to hold the fork as you do this to stop it popping back out of the frame. With the stem aligned with the fork, grease and screw in the compression bolt and stem top cap. Leave the stem bolts loose but check that all spacers, the stem, and the headset stacks are all seated evenly.

- ✓ 4 and 5mm Allen keys
- ✓ Rubber mallet
- ✓ Headset grease
- ✓ Large flat-bladed screwdriver
- ✓ Crown race installer
- ✓ Tape measure
- ✓ Steerer saw guide
- ✓ Flat and round files
- ✓ Star-fangled nut installation tool
- ✓ Torque wrench

WORKSHOP WISDOM

Angle-adjusting headsets such as Cane Creek's Angleset are a simple way to change the geometry of your bike (see P124). They're used to increase or decrease the head angle. That's achieved by using offset headset cups to angle the fork, with the bearings sitting in either movable gimbals or fixed cups that have to be accurately machined to fit a specific head-tube length. The exact fitting procedure varies from model to model, so check manufacturers' instructions.

2 UNDO STEM CLAMPS

Using a 4mm Allen key, undo and remove the stem top cap and compression bolt that serves to preload the headset bearings. Undo the stem clamp bolts using a 5mm Allen key and slide the stem and any spacers off the fork steerer, making a note of how many spacers (and what heights) were above and below the stem. Remember to hold the fork crown with your free hand to stop it falling out of the frame.

3 DROP THE FORK OUT

Drop the fork out of the frame by holding the fork crown and pulling downwards. If the fork is stiff, you may need to tap it out using a rubber mallet or by putting a block of wood on top of the steerer tube and then tapping that to prevent damaging anything. Take care that the headset bearings and hardware don't fly off, or get lost or damaged. Again, lay them out on a clean surface in the order they were removed.

4 CLEAN AND INSPECT

While the headset is already disassembled, it's a good opportunity to clean it and inspect the bearing and bearing races for wear and tear. If you spot damage, you'll have to replace parts or even install a new headset, so it may be worth checking out a reputable bike shop if that's the case.

8 CUT TO LENGTH

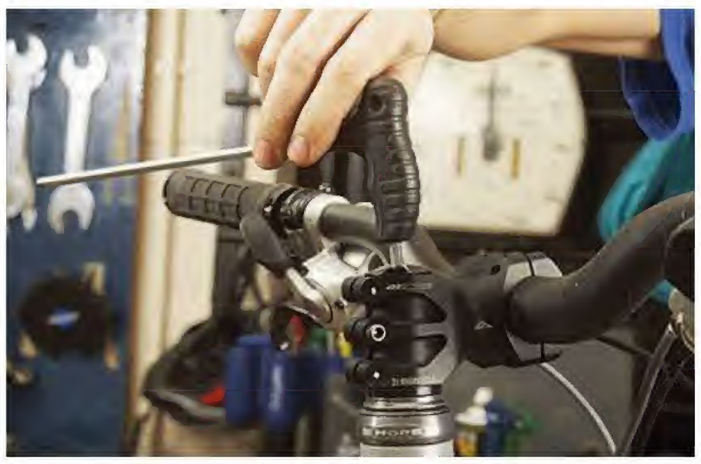
You now need a saw guide that corresponds to the fork's steerer – either 1 1/8in or 1.5in. Place the fork steerer into the guide until the scribe or pen mark is visible between the guide plates, then secure the guide on the fork by tightening the clamp. Place the guide securely into a vice and carefully cut through the steerer using a hacksaw.
Alternatively, use a pipe cutter.

9 FILE THE CUT FLAT

Once cut, undo the guide clamp and move the steerer so that it protrudes slightly over the guide plate. Using a flat file, clean the cut until it's a level surface. Undo the guide clamp and push the steerer through further still, then secure once more before using a round file to take off any sharp edges around the cut and to add a slight bevel on the outside. Remove the fork from the vice and also from the cutting clamp.

10 ADD STAR-FANGLED NUT

Using a star-fangled nut installation tool, thread the star-fangled nut into the tool with the convex side facing outward of the tool. This will face down in the head-tube and prevent the nut from being pulled upwards.



14 PRELOAD COMPRESSION

Tighten (preload) the compression bolt with a 4mm Allen key with two fingers, checking that there is no noticeable play (slack) in the headset and that the fork turns smoothly and easily. Tighten or ease off the preload as necessary to get it perfect.

15 TIGHTEN STEM CLAMP

Tighten the stem clamp with a 5mm Allen key and, by refitting the front wheel, check that it's in line with the stem. Adjust as necessary by undoing the stem bolts, easing off the headset preload, tweaking the stem's position and retightening the preload and then the stem bolts as described above. Once done, cinch up the stem bolts to the recommended torque settings.

16 FIT AND SET BRAKES

Reinstall the brakes and check, as necessary, that they're set up correctly. You may need to shim the disc brake calliper bolts to prevent the calliper rubbing on the disc itself if using an International Standard (IS) mount. If you're using a Post Mount (PM) set-up, slacken off the mount bolts and adjust the calliper's position from side to side before tightening again.

ROAD
OFF-ROAD

BEGINNER **EXPERIENCED** EXPERT

2 hrs

£50-£500 for new fork

HOW TO FIT A NEW FORK

Upgrading your fork can save weight, sharpen the steering, and improve ride comfort. Here's how to get the job right first time

There are many good reasons to upgrade your fork, from saving weight to adding the amount you can carry when touring. A new fork can open up mudguard and rack options too.

Almost all road bikes are now fitted with threadless (Aheadset) type forks and headsets. The bearings are easy to adjust using a single Allen bolt in the top cap, locked into place by the stem clamped to the steerer. The Allen bolt is normally fastened to a star washer in a steel or aluminium steerer, or an expander bung in a carbon fibre steerer. Never use a star washer with carbon. Spacers can be used below or above the stem to adjust handlebar height.

Forks with carbon fibre steerers are a lot lighter than steel or aluminium forks, but need more care in fitting and use. Carbon steerers cannot be used with all types of handlebar stem. Those which clamp around the whole circumference of the steerer are fine, but those which clamp with a narrow wedge may damage the steerer with catastrophic results.

With an Aheadset set-up it's a good idea at first to fit more packing washers above and below the stem. When you are certain about your stem position, you can remove the forks and cut a little extra off the steerer and use less depth of washers.

When fitting new forks there are several steps that may require special tools. These are clearly indicated in the text on these pages. Don't hesitate to ask a good local bike shop to perform these steps for you. It's quite easy to cause damage, especially to headsets, by not using the proper tools.

1 BEFORE YOU BUY CHECK THE SIZE AND TYPE

Older bikes will mostly be fitted with a 1in threaded headset and a stem with a quill that inserts in the fork, locked in by either a wedge or an expander bolt. These frames can be upgraded to carbon fibre forks with threadless (Aheadset) steerers with a new headset, though 1in threadless forks are not as common so may need to be ordered specially. More modern road bikes will use a 1in threadless system and when upgrading you can still use your old headset. More recent road bikes use 1 1/8in steerers and there is a large variety of forks to fit. Many will also use integrated headsets (where the cups fit in recesses at both ends of the head-tube); special forks which closely match the profile of the head-tube are available.

5 REMOVE HEADSET RACES

With integrated headsets the bearings can simply be lifted out – no further parts will need to be removed. With all other headsets remove any bearings and seals from the frame races and fork crown race. Slide the sprung jaws of the headset cup tool through the head-tube and push back to engage the headset cup edges. Use a mallet on the tool's end to drive the cup out. Remove and reverse the tool to remove the other cup. If you do not have the special tool the cups can be removed with the aid of longish drift or old large screwdriver. Place the drift or screwdriver blade on the inside edge of the headset cup inside the head-tube and, working from side to side, carefully tap the old cup out. Be careful not to dig into the head-tube or to jam the cup sideways.

6 FORK CROWN RACE

The fork crown race, if steel, can be tapped free from the underside of the fork crown with a blunt screwdriver. If it's aluminium a proper crown race remover should be used. If integrated style forks are used and the back of the crown race is not accessible it will be essential to find a shop with the special Park or VAR tool. To install the new fork crown race use a piece of 1 1/8in tube with 1in headsets and with 1 1/8in headsets, use a piece of 1 1/4in diameter tube. Fit the crown race in position at the bottom of the fork, making certain it is as square as possible to the steerer. Use the tube like a slide hammer to force the race onto its seat. Make certain that it is seated evenly and fully on the fork.

7 FITTING HEADSET RACES

If fitting a replacement integrated headset make sure you buy the correct one. They are made to two standards, essentially Italian and Japanese, though there are others. With non-integrated headsets place the lower deeper frame cup and shallower top cups approximately in place. Fit a headset press in place. Using two spanners tighten the nuts, carefully pressing the cups into position. Ensure that the cups seat perfectly squarely and fully into the frame. A makeshift headset press can be made from 1/2in studding and two old style bottom bracket cups or sockets to press on the cups' internal surfaces, held together with the appropriate nuts.

- ✓ Tape measure
- ✓ Long straight edge
- ✓ Old front hub axle
- ✓ Vernier calliper/steel rule
- ✓ 5 and 6mm Allen keys,
- ✓ Hacksaw with 32tpi blade
- ✓ Vice with soft jaws
- ✓ Tube cutting guide (not essential)
- ✓ Soft faced hammer
- ✓ Half round file
- ✓ piece of 1 1/8in (1in headset) or 1 1/4in tubing (1 1/8in headset),
- ✓ Fork crown race removal tool.

For non-integrated type

- ✓ A headset cup removal tool
- ✓ Headset cup fitting tool (or studding and old BB cups).
- ✓ A drift or large blunt screwdriver can stand in for race and cup removal tools with care.

WORKSHOP WISDOM

Fork offset is the distance between the centre of the dropout and a line straight down the middle of the fork steerer to the bottom of the forks.

Head angle is the angle between the head-tube and a horizontal line. It affects steering speed and reach.

Trail is the distance between the tyre contact spot and the point at which a line through the centre of the head-tube intersects the ground.

- Trail (cm) = wheel radius (cm)/Tan head angle - Fork offset (cm)/Sin head angle

For stable handling at speed on time trial or touring bikes a trail figure between 6-7.5cm is desirable. For road bikes, trail between 5-6cm produces a quicker-responding bike that remains easy to ride.

2 MEASURE THE OLD FORK

Fit an old front hub axle fully into the dropouts. Measure fork length from the underside of the fork crown race to the centre of the axle in a straight line. Next, measure fork offset which is the distance between a line taken through the centre line of the head-tube and the dropout at a right angle. Line up the long straight edge with the centre line of the head-tube and the fork crown. Measure the horizontal distance between the centre of the dropout and the edge of the straight edge - this is the fork offset. A longer fork offset will decrease trail (see glossary) and make the frame less stable, a shorter fork offset will increase a frame's stability.

3 MEASURING A NEW FORK

Make exactly the same measurements as in 2, this time lining up the straight edge with the centre line of the steerer. A replacement fork that is within about 3-4mm of the same length as the old one will barely affect the handling. Longer forks will reduce the frame's head angle and shorter forks will increase the frame's head angle. A steeper head angle will reduce trail, lessen stability and increase the steering quickness. A shallower head angle will do the reverse. Most modern forks will be very similar in length and offset except on very small or large frames or one where the fork length is longer to give some mudguard clearance. With a longer or shorter fork it may be necessary to change the front brake calliper if the brake shoes are close to the top or bottom of the slots in the calliper.

4 REMOVE BAR AND STEM

Undo the front brake calliper securing bolt and remove. With threaded forks undo the stem expander bolt about four turns, knock down with a soft faced hammer, and pull the bar and stem from the fork. Use a headset spanner to hold the top headset adjusting nut, unscrew and remove the headset locknut with a second spanner. Remove any spacing washers. Unscrew the top headset race and withdraw the fork from the frame. With threadless forks loosen the top adjusting bolt and remove. Remove spacing washers and loosen the stem fixing bolts. Pull the bar and stem from the fork and tie out of the way with the front brake. Tap the top of the steerer with a soft-faced hammer to remove the fork. Remove the headset parts and take note of the order as you remove them.

8 MEASURING AND CUTTING THE STEERER

Loosely assemble the bearings onto the crown race and top frame race. Fit the fork in place and slide the top race into place. Measure the depth of your stem and the spacers you wish to use. Measure the length of steerer protruding. Remove stem, headset parts, washers, and the fork. Make a mark on the steerer at this distance from its top end, measure 3mm further down the steerer and make a further mark. This is where you will cut the excess length of steerer off. Fit a tube cutting gauge - or draw carefully with a marker pen all the way around the steerer. Hold the fork column in a vice with soft jaws and, with a hacksaw, cut the steerer excess off. Clean up the top edge with a half round file.

9 FITTING THE FORK AND NEW BEARINGS

Star fangled washers must not be used with carbon fibre steerers – a suitable expander or plug will normally be supplied with a new fork. If fitting a star fangled washer, position it dish upwards over the steerer end and knock it down 15-20mm. With non-cartridge style bearings pack the ball races and bearing cups with waterproof grease. Fit the bearings, taking care to get them the correct way up, and slip any seals into place. Slide the fork in, followed by the sliding top race, spacing washers, stem and further spacers. Press the whole assembly together tightly. The top of the stem or top spacer should sit 3-6mm proud of the steerer top.

10 FINAL ADJUSTMENT, BAR AND BRAKE REFIT

Screw the adjusting top cap to the star fangled washer nut. If an expander plug is used, push into place and tighten it into position before fitting the top cap and screw. Fasten the front brake into position. A longer Allen nut may be necessary with some forks, this is normally supplied with the fork. Tighten the top cap bolt until all play is removed from the headset, but ensure that the fork still rotates freely. The most sensitive place to feel play is at the crown race if the bike is rocked with the front brake on. Take care to get this adjustment exactly correct. Align the stem with the fork and tighten the bolts that clamp it to the steerer. Recheck the adjustment after a few miles.

ROAD
OFF-ROAD

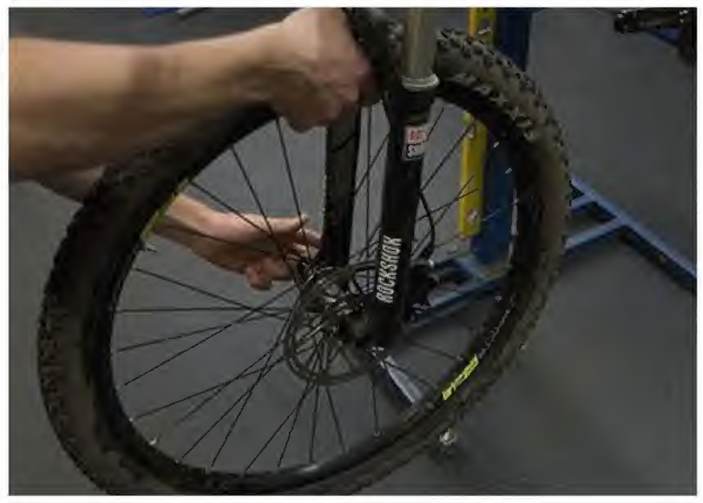
BEGINNER EXPERIENCED EXPERT

40 mins

Varies

REPLACE YOUR HEADSET

If your headset's creaking or wobbling and beyond repair, follow this step-by-step guide to swap it for a new one.



1 REMOVE FRONT BRAKE

Ensure your bike is clean and clamp it securely in a workstand. Remove the front wheel. Undo the bolts securing the front brake lever to the handlebar, turning them anticlockwise with the appropriate tool. Put the bolts and lever clamp somewhere clean and safe. Allow the lever body to hang by the fork.

5 REMOVE THE FORK

Set any headset spacers below the stem aside with the others. Slide the fork out of the frame and set it aside. Remove the headset's top bearing cover, upper race and seals. Put them next to the spacers, in the correct order. Pick out the headset bearings with your fingers (they may be loose balls or cartridge bearings) and set them aside, or discard them if pitted.

6 SET REMOVAL TOOL 1

Use the appropriate headset removal tool to remove the lower headset cup – for tapered steerers, you'll need a different tool for the lower and upper cups because they'll be different sizes. Pull the tool up through the head tube with the barbs pointing downwards until the barbs pop out into the head tube.

7 SET REMOVAL TOOL 2

Push the headset removal tool back down firmly until the barbs all sit flush on the rim of the lower headset cup. Look to make sure all three barbs are properly seated on the outer edge of the cup – they can sometimes get caught on the head tube, which can cause damage to the frame.

11 ASSEMBLE CUP AND PRESS

Wind the handle of the headset press almost fully anticlockwise. Slide the new lower headset cup over the shaft along with the appropriate adaptor to press it in. Thread the shaft of the tool down through the head tube until the headset cup sits on the end of the head tube. Slide the lower plate up the shaft of the tool and clip it onto the highest notch you can.

12 PRESS NEW CUPS

Turn the handle clockwise, ensuring that the tool is kept squarely in line with the head tube. Continue to turn the handle until the lower headset cup is fully installed in the frame and there's no gap between the cup and the head tube. This shouldn't take much force. Return the bike to the correct way up and repeat steps 11 and 12 with the upper headset cup.

13 INSTALL NEW BEARINGS

Grease the inside of the headset cups and install the new bearings. Clean the fork's steerer tube, check the crown race is correct for the headset, then slide the steerer into the head tube. Add the upper race, seals, bearing cover and spacers. Slide the stem on, replace any other spacers and reinstall the top cap, turning the bolt clockwise to the recommended torque setting.

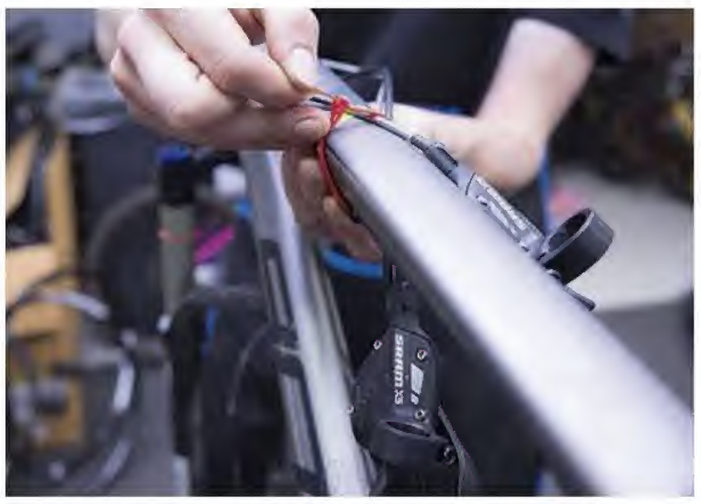
- ✓ Headset press
- ✓ Headset removal tool(s)
- ✓ Grease
- ✓ Degreaser
- ✓ Rubber mallet
- ✓ Torque wrench
- ✓ Allen key set (plus Torx keys if needed to remove controls)
- ✓ Ziptie
- ✓ Cleaning rags

WORKSHOP WISDOM

We know what you're thinking. Yes, it's possible to replace a headset without the proper tools, but no, we don't recommend going down this route. Whether you're taking out an old headset without a headset removal tool or installing a new one without a press, it's all too easy to damage the head tube, ruining the frame. The new headset may be damaged too, or just wear out faster due to poor installation. Headset presses are expensive, so it's worth getting to know your local bike shop – many will let those who know what they're doing use their tools. Alternatively, find a mate with headset woes and go halves on buying the right tools.

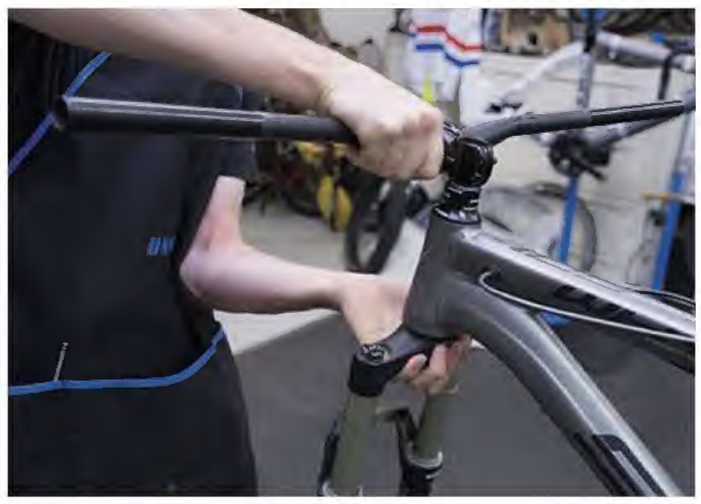
2 REMOVE OTHER CONTROLS

Now remove the rest of the controls – shifter(s), rear brake lever, dropper post lever – from the bar, using the appropriate Allen and/or Torx keys and turning them anticlockwise. If the controls have split clamps, undo the bolts and pull the controls off. If they have fixed clamps, loosen the bolts, remove the grips and then slide the controls off the bar.



3 SECURE ON THE TOP TUBE

With the rest of the controls removed from the bar, gently pull them back and secure them to the top tube with a ziptie so they're out of the way.



4 REMOVE THE STEM

Loosen the stem's steerer clamp bolts, turning them a few turns anticlockwise with the appropriate size Allen key. Hold the fork in one hand and use the appropriate size Allen key to remove the stem's top cap bolt, turning it anticlockwise. Set the bolt, top cap and any spacers aside, in order. Pull the stem off the steerer tube, then set the bar and stem aside.

8 REMOVE LOWER CUP

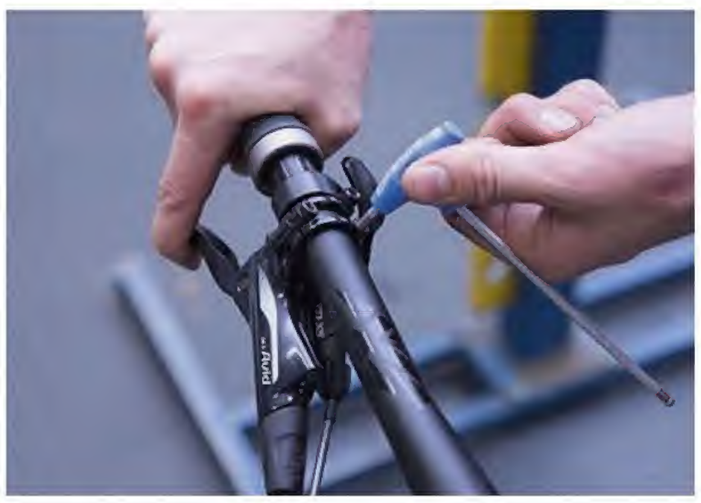
Hold the headset removal tool with one hand so that the handle is centred within the upper headset cup. Give the top of the tool a firm vertical tap with a rubber mallet. Check that the tool is still properly sitting on the lower headset cup before hitting it again. Repeat until the lower cup falls out of the head tube.

9 REMOVE UPPER CUP

If your workstand allows, turn the bike upside down. Repeat steps 6 to 8 on the upper headset cup, using the correct size headset removal tool. Discard the old headset cups.

10 CHECK THE HEAD TUBE

Use degreaser and rags to clean the inside of the head tube thoroughly. Inspect it for cracks or signs of damage. If everything's OK, grease the inside of the head tube liberally and apply grease to the outside of the new headset cups too.



14 REFIT THE CONTROLS

Refit the controls (and grips, if removed) to the bar in a reversal of steps 1 and 2, taking care to fit them in the correct order and only doing the bolts up loosely. Remove the bike from the workstand and check the controls are in the most ergonomic position possible before tightening the clamp bolts clockwise until snug.

15 ALIGN STEM AND BARS

Align the stem with the front tyre and the bar with the dials on the fork crown – this will ensure the bar is straight. To make adjustments, hold the bar while tapping the wheel with one foot. Once straight, tighten the stem's steerer clamp bolts, turning them clockwise to the manufacturer's recommended torque setting.

16 CHECK FOR PLAY

Pull the front brake lever with one hand and use the other to rock the frame back and forth while feeling for play between the frame and headset. If there is play, loosen the stem clamp bolts (anticlockwise), tighten the steerer bolt (clockwise), straighten the bar and retighten the stem clamp bolts (clockwise).

ROAD / OFF-ROAD

BEGINNER | EXPERIENCED | EXPERT

up to 1 hr

Degreaser £5, grease £5, new bearings approx £6

HEADSET MAINTENANCE

Look after your headset and it will look after you. Neglect it, and it will turn against you, grinding and knocking as you ride, and ultimately costing you money

It's easy to ignore your headset. It's buried in the head-tube of your frame, with none of its crucial mechanicals visible. The whole time it does its job of providing smooth steering and braking, faithfully securing your fork, you don't have to think about it. Then, one day, you hear a noise or feel a clunk. This is your call to action, before your wallet gets a hit.

Different kinds of headset set-ups require various techniques for adjustment, so we'll go through a selection here. Adjusting a threaded headset is straightforward, two spanners' worth on our scale, so don't be afraid to give it a go. Fitting a replacement is a much more involved task though. Four spanners for that one.

Some of the following advice should be seen as a temporary measure, useful in order to stretch out the life of your headset until you can find the time and money to get it replaced. If the following steps don't get results, or you're still concerned about safety after doing your adjustments, then get the job done professionally by your friendly local bike shop.

1 DIAGNOSE AND ADJUST A THREADED HEADSET

Bounce the front wheel off the ground a few times: a rattling sound indicates the headset is loose. If the bars lock in the middle and point straight, it's either overtight or the bearings are heavily worn. Holding the front wheel or frame between your legs, with the bars as leverage, carefully place a 32mm headset wrench over the locknut and turn anti-clockwise. If it's particularly tough, try turning the lower cup clockwise to free it, releasing the top locknut. Adjust the lower cup until there's no play, but free movement, then lock down the top nut.

5 AHEADSET/THREADLESS HEADSETS

In order to readjust the headset correctly, you need to understand that the stem has to be able to slide up and down on the steerer and should be loose before tightening the top cap. First, release the steerer clamp bolt or bolts on the stem completely. Make sure you alternate for twin bolt stems, since loosening one bolt tightens the other. Now nip up the top cap bolt. This will draw the fork upwards, sandwiching and tightening the bearings, so don't overdo it. Tighten twin stem bolts gradually until an even torque of 5-10Nm is achieved.

6 GET A GRIP

Aheadsets, or threadless headsets, rely on an internal 'gripper' device placed in the fork steerer tube, which is pulled up using the bolt held in place by the top cap. This draws the bearing assembly together by pulling against the stem, making adjustment possible. It's therefore necessary for the top of the stem clamp to sit a few millimetres higher than the top edge of the steerer tube. The star-fangled wedge on the right of the above image is used to grab steel and aluminium steerers. The wedge on the left is preferable for carbon or thin-walled aluminium steerers. If you have a deeper nylon stem cap (as on the right headset), ditch it for a shallower alloy one (as on the left).

7 REMOVE CARTRIDGES

If a simple adjustment doesn't do it, replacing cartridges or loose bearings is relatively easy. Remove the top cap and stem, and if the fork doesn't simply pull out, tap the steerer with the resin hammer to dislodge it. If it proves unruly, try prying the upper cone wedge away from the cone, holding on to your fork to keep it from falling to the floor. Note that if you have a Campagnolo headset with an expander wedge instead of a star-fangled washer, the non-split cone wedge can sometimes become stuck due to slight expansion of the steerer tube (this goes for some Dia-Compe models too). In this case, loosen the expander wedge first with a few turns of its Allen bolt, then give it a tap.

- ✓ Headset wrenches 32 or 36mm
- ✓ 4, 5, 6mm Allen keys
- ✓ Resin hammer
- ✓ Degreaser and grease
- ✓ Torque wrench
- ✓ FSA headset guide tool
- ✓ Thin Aheadset washers
- ✓ 5/32 or 1/8in loose ball bearings or headset cartridge bearings

2 QUILL STEM REMOVAL

For quill stems, you'll need to dislodge the stem wedge first in order to remove the stem. Using an Allen key, loosen the wedge bolt by turning it anti-clockwise until it protrudes just enough to give it a sharp blow with a resin mallet (keep a few threads engaged to prevent the cone or wedge from dropping into the steerer). Remove the stem and bars, and attach them to the bike's top tube with a zip tie. Drop the fork by removing the brake, and the mudguard if required, then unthread the locknut and upper cup. Remove the bearings and clean with a cloth and degreaser or WD40.

3 INSPECTION: CONE AND CUP WEAR

The following applies to all standard ball-bearing headsets. Look closely at the surfaces of the bearing path – if it's worn, then evenly spaced pockmarks should be clearly visible, each little crater corresponding to an individual ball bearing. When the headset is ridden too tight or too loose over extended periods, each bearing gradually carves out a little nest for itself. The process is greatly accelerated by grit and contamination from wet conditions. There is a fix, however: packing in extra bearings where there were none before.

4 IN WITH THE SMOOTH

Having removed the fork and ensured everything is clean, take a few of your bearings to your local bike shop for a match – they're relatively cheap and will either be 1/8 or 5/32in diameter. Now add a dollop of grease, enough to hold the loose balls in place, and add bearings until they fill the cup, ensuring they're correctly positioned in the race on the bearing path. Because we're cheating a bit here, it's okay if they touch lightly. The idea is to end up with bearings occupying the undamaged areas of the cones and cups. Then readjust the headset correctly. Refer to step 5 if you have an Aheadset.

8 REPLACE CARTRIDGES

Now compare the two cartridges and notice the differences in the length of the angled and straight sections. These cartridges are available in a number of configurations, so hang on to your originals to ensure you can always get a good match. If you have a seriously neglected fully integrated headset or lower cup, a thin strip of PTFE tape and a few drops of bearing adhesive might be your only recourse. With today's modern integrated headsets, determining which kind of bearing goes into the frame can be a hit and miss process; to make it less of a chore, FSA produces a smart template (see 'Tools'), consisting of a metal plate featuring different cup and cartridge profiles.

9 TROUBLESHOOTING

Replacing the cartridges should remedy any rattle and poor steering. Sometimes the upper cup, cone wedge, spacers and stem won't adjust correctly due to the upper edge of the top cup coming into contact with the lower edge of the cone cap. This is a frequent problem that will cause binding of the headset and handling difficulties. The resulting friction can be remedied with a thin spacer or two (Hope produces one measuring 0.4mm in thickness) that will prevent the edges from coming into contact and causing drag when placed between the cone wedge and cone cap. Apply a thin layer of grease between the metal elements, and take care to avoid carbon steerers.

10 MIND THE GAP

When dealing with headset adjustment, look out for the stem already being level or slightly below the upper edge of the steerer with the stem cap bottomed out. You'll need to stack enough spacers below or above the stem to achieve the gap illustrated above. If you don't have sufficient stem or spacer protruding, you won't be able to correctly adjust the headset. Now ditch the nylon Dia-Compe cap (shown on the right) in favour of a shallow alloy one. Check the expander wedge or star-fangled washer is well anchored and not slipping upwards. Make the final adjustment by acting on the top cap bolt, then carefully re-torque the stem as in step 5: the twin bolts should be about 5-7Nm.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

60 mins

Around £10 for degreaser and grease, £10 for cone spanners if you don't already have some

SERVICING BEARINGS

How to service cartridge and loose headset bearings plus cup and cone bearing hubs to keep them running smoothly and increase their lifespan

1 REMOVE THE SEAL

Once you have removed the bearing from the headset, you need a sharp scalpel blade and a steady hand to slide the tip of the blade between the outer steel case of the bearing and the outer edge of the black (sometimes orange) seal. With the tip under the seal, gently twist the blade towards the inside edge of the seal – it will pop out. The seal is rubber coated but has a metal core, so don't bend it!

5 REFIT THE SEAL

When you're happy that the cartridge bearing is full of fresh, clean grease, you can refit the seal. As we've mentioned, the seal has a metal core and once bent will not properly fit (or seal) the bearing. So gently place the rubber-coated seal on top of the open bearing and use your thumbs to ease the seal back into its grooved seat without adding undue pressure. You should feel it seat into place.

6 REMOVE LOOSE BEARINGS

Threadless headsets with loose caged balls can be lifted out with a scalpel or similar tool. If there is grease on the balls they should stay in position; however, dry races may cause odd balls to drop out. Given their tiny size, they're easily lost, and even when you find them again they're not easily reintroduced into the cage. Go carefully.

7 CLEAN LOOSE BEARINGS

Use a spray of degreaser to shift the worst of the grime, then get to work on the bearings with a lint-free rag. Be very careful to avoid popping the individual ball bearings out of the cage — they're tough to replace, especially without damaging the cage. As with cartridge bearings, brighter is better with loose ball bearings. If they look tired, they probably ought to go.

11 CHECK POSITION CAREFULLY

It is vital that the caged loose balls are placed back into the headset cups the right way (balls towards the head tube). If the cages get replaced the wrong way around, they simply won't spin. Trouble is, by the time you notice – usually when you do the headset up – you've knackered them.

12 UNDOING CUP AND CONE HUBS

Cup and cone hubs will require a pair of thin cone spanners to undo the axles and gain access to the bearings. Once undone, carefully lift the axle clear of the hub. Be careful not to disturb or dislodge any of the bearings, which should remain in their seats, as they sometimes stick to the axle as you pull it out or drop out from the bottom end of the hub.

13 REMOVE HUB BEARINGS

Use a scalpel blade to carefully remove the loose balls from each side of the hub. There should be 10 ball bearings per side. To help lift them out, you may find it easier to add a little grease to the scalpel blade; this helps the individual loose balls stick to the blade. Place each ball into a small container to prevent losing them on the floor.

- ✓ Lint-free rag,
- ✓ Scalpel, grease (with gun),
- ✓ Cone spanners,
- ✓ Degreaser (with straw nozzle)

WORKSHOP WISDOM

Get a magnetised screwdriver blade to make life easier for yourself when removing loose ball bearing from a hub; the balls will stick to the magnetic tip without the need for more sticky grease. Either buy one pre-magnetised or magnetise your own screwdriver by dragging its blade over a strong magnet several times in the same direction.

2 CLEAN CARTRIDGE BEARING

Use a can of spray degreaser with a fine straw applicator to direct a jet of degreaser into the bearing assembly. With the bearing full of degreaser, keep turning the bearing to break the grease down, and continue to flush with degreaser until it's clean. This may take five minutes and a few applications of degreaser, but do get it all out.

TIP

Use some workshop rubber gloves to protect your hands when working with grease. They're thin enough to let you can work on the smallest of parts without any loss of feeling, and you'll have less scrubbing to do when you clean up afterwards.

3 DRY CARTRIDGE BEARING

Use a lint-free rag to dry the bearing; you don't want to fill the bearing up with rag fluff. Only now can you get a real picture of the state of the bearing. If the bearing is shiny or dull silver, that's a good sign. If the bearing is black or dark grey but still feels acceptably smooth, eke out the last of its performance by giving it a service. If it's notchy, best to throw it in the bin.

4 ADD GREASE

It's time for the grease to go in. Which brand you go for is less important than how much you use; don't skimp. Also, because the balls are shielded somewhat by their cages, a smear of grease may not actually reach them. You'll need to work the grease in there to ensure all the metal-to-metal surfaces are shielded from each other.

8 CHECK BEARING SEATS

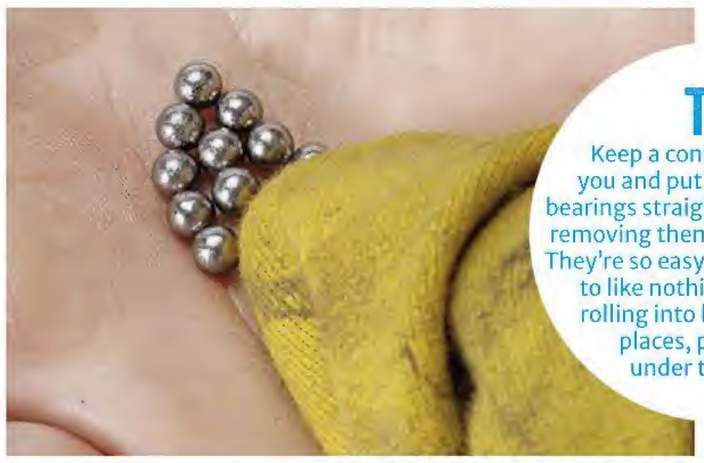
Wipe the bearing seats out. They'll almost certainly need a dousing with degreaser (we've removed ours from the frame for clarity). You'll see a silver line worn through the black paint (or a grey line on a silver seat) where the balls make contact with the seat. Ingress of dirt can cause corrosion, leading to pits, imperfections and cracks in the surface that result in poor performance.

9 APPEARANCES MATTER

Here are two cages of loose balls taken from two different threadless headsets. The left-hand one is from a bike with a year's worth of use. Its balls are grey, although still uniform and without serious damage. There's another few months of use left here as long as they get a good greasing. The set on the right-hand side is nearly new, and if looked after properly will look like this in a year's time.

10 REPLACING LOOSE BEARING CAGE

When you replace the caged loose balls back into the cup (shown here out of the frame for clarity), ensure the cage is sitting on a bed of grease. It is unshielded metal-to-metal contact that causes the rapid wear to the bearing and to the bearing seat. Voids inside the bearing can also be filled by water ingress causing faster breakdown of the grease. So fill it up.



TIP

Keep a container next to you and put your loose ball bearings straight into it as you're removing them from your hubs. They're so easy to lose, and seem to like nothing better than rolling into hard-to-reach places, particularly under the fridge.

14 DEGREASE BALLS

Add a spray of degreaser to the balls and rub over with a rag. The balls should be bright, shiny and uniform in appearance. If there are any dents, misshapen balls or dark discolouration, it's worth replacing them. This is even more important with hubs than headsets. Headsets are relatively cheap to replace, but changing your hubs will require a costly wheel rebuild.

15 CLEAN HUB BEARING SEAT

Clear out the hub's bearing seat with some degreaser and a cotton bud, and inspect it. It's important that the bearings are refitted into a bed of fresh grease. Don't be stingy with the grease; any excess will work its way out. Also be careful when replacing the axle in the hub, because the movement of the axle can cause the balls to catch it and become dislodged.

16 TIGHTEN CONE AND LOCK WASHER

With the axle back in position, you need to retighten the cone and lock washer correctly. This requires a little practice to get right. You want to leave the bearing adjusted so that it turns smoothly with no catching, but also with no perceptible play. If there's any play in the hubs, it will make the wheels sound awful when ridden and ultimately cause extra wear and tear on the bearings.

TRAVEL AGENTS

Setting up your bike's suspension properly can really enhance the fun you have out on the trail. It isn't rocket science and learning how suspension works can help unleash the performance potential of your steed

Before suspension, mountain bikes were bone-shakers. Rough sections of track were exhilarating rollercoasters, but had you grimacing and wondering how the hell other people could ride it any quicker.

When suspension was first introduced, many riders turned up their noses at the ugly, heavy, flexy and very inefficient early designs. But nowadays it's a different story.

Modern suspension bikes allow you to ride faster, further and for longer over uneven surfaces because they reduce impact and strain on your body. They smooth out ugly landings and get you out of trouble when you find yourself totally out of your depth.

Suspension has two jobs on a bike: to keep the wheels in contact with the ground as much as possible to improve traction, and to cushion the impacts a bike deals with on rough terrain. If it's not set up correctly, a great suspension bike can feel like riding a mattress and really hold you back. Once you get your bike dialled in, however, it will feel like a vastly improved machine and your riding will take a leap forward as a result.

SUSPENSION TYPES

These days most bikes come with suspension of some kind and it all operates in the same way, with just a few variations to how it can be fine tuned.

Suspension comes in two forms: coil sprung and air sprung, (the latter being the most widely used these days), but all suspension features compression and rebound damping to adjust the rate at which the fork dives through its travel and returns. Cheaper shocks and forks may lack external adjustments, but almost all forks and shocks now have external rebound controls as a minimum.

Well set up suspension lets the wheels follow the contours of the terrain by letting the bike extend down into hollows and move around rocks and lumps.

To do this, suspension is set up with sag – meaning your given weight on the bike allows the bike to sit at a point that you set yourself within the travel. Sag should be set between a quarter and a third of available travel, but check your suspension manual.

FRONT FORKS

Fine-tuning your front suspension

SPRING PRELOAD

Suspension forks are either coil sprung or air sprung. Coil sprung forks have a preload feature.

The common misconception of spring preload is that it makes your spring rate harder – it doesn't. If your fork is too soft, then you need a harder spring. Adding preload only alters the initial force required to move the spring, which affects ride height and can make the fork feel harder.

AIR SPRINGS

Unlike a coil-sprung fork, air is used as the spring. It's naturally progressive in a confined space, and is almost infinitely adjustable.

COMMON VARIATIONS

Solo Air – RockShox
A simple single air valve system.

Dual Air – RockShox
A more advanced option with a twin air chamber set-up – one valve for the main spring and the other for the negative.

2-Step – RockShox
The Solo air system with a hydraulic travel adjuster, which allows a shorter travel 'climbing' mode and a longer travel 'descending' mode.

U-turn – RockShox
Available in both air and coil spring varieties, this enables adjustment of fork travel at the turn of a dial.

TALAS – Fox
Fox's travel adjustment system, with a single air valve. The travel can be adjusted to two different settings: either 120 and 160mm or 120 and 150mm.

Float – Fox
A simple single air valve system.

SFA – Marzocchi
Another simple single air valve system.

ATA – Marzocchi
A dual air design – one valve for spring, and the other for progression. Also features a travel adjust dial with approximately 40mm of adjustment (this varies depending on the model).

COMPRESSION

Low-speed
Damping applied to the fork for small bump sensitivity, when the fork is moving small amounts at a lower speed. This can also minimise the bobbing action from rider weight.

High-speed
Damping applied to the fork for large hits, when the fork must move quickly. Too little and you'll bottom-out regularly, too much and you'll feel the impact of the bump.

COMMON VARIATIONS

TST Micro – Marzocchi
The red dial adjusts the compression, while the gold dial adjusts the threshold of the compression dial – if both of these are fully clockwise the fork will be locked.

TST 2 – Marzocchi
A simpler system comprising just a single compression dial – turning it fully clockwise will lock the fork.

APD (Absolute Platform Damper) – Manitou
Operated by a dial, this lightweight six-click compression adjustment ranges from fully open to locked out.

TPC – Manitou
This uses a cartridge design, featuring entirely separate chambers for compression and rebound damping. Compression can be adjusted all the way to lock-out.

Launch Control – DT Swiss
Pushing this button closes the rebound damping, so that when pushing the fork down it will stay at that height, which is ideal for climbing. An adjustable release threshold dial allows return of the fork after an impact.

RC2 – Fox
Hidden under a screw-on protective cap are a pair of separate high- and low-speed compression adjusters.

Mission Control/Floodgate – RockShox
Low-speed compression adjustment with threshold dial that allows full lock-out.

Motion Control – RockShox
Uses a simple blue dial to adjust compression.

RC3 – Marzocchi
Features rebound damping from the black dial, and both high- and low-speed damping from the red dial. On the 888 fork, the VA knob controls the air volume, adding progressiveness.

RCV – Marzocchi
The black knob controls rebound damping and the red knob controls compression.

IFP Intrinsic – Manitou
Compression damping, with an adjustable internal air cartridge for progression.

REBOUND

This refers to the control of the fork's return speed after compression. A happy medium should be met between fast enough to return between hits and slow enough to avoid being kicked by bumps.

LOCK-OUT

Compression damping at its extreme end – most fully wound compression adjusters will offer near-locked motion. Many forks offer a lever specifically for locking out the action for climbing and riding flat sections with few or no bumps.

SETTING SAG

Correctly set sag is crucial for fully functioning suspension

This is the most important initial setting for your suspension, since it determines if you're using the available travel as freely as you should be, and that the suspension is doing its job. Ensuring your bike's pivots are moving freely will get the best results.

Before you set up the bike, slip into your riding gear for an average day, complete with riding shoes, helmet and a full pack – the weight you carry with you needs to be taken into account in the adjustments. Ensure that if your bike has adjustable compression you wind or switch it off while setting sag.

1 READING REAR SHOCK SAG

To measure your rear shock's sag, reset your rear shock's O-ring (or a zip tie), then balance against something sturdy, gently sit on the saddle of the bike, put both your feet on the pedals and your hands on the handlebars.

2 MEASURE THE O-RING'S MOVEMENT

Then get off the bike as carefully as you can, and look at how far the O-ring has moved – this represents your sag. Ideally you're looking for movement between a quarter and a third of the total shaft movement (check your owner's manual for details).

3 ADD OR REMOVE AIR AS NEEDED

If it's moved too far or not enough you need to make an adjustment. For a coil shock, you'll need to add or take away pre-load on the spring by turning the spring retaining ring. If you need to use more than six complete revolutions in either direction, the spring is too soft or too hard and needs to be changed. For air shocks, you have the ability to adjust the pressure almost infinitely. It's well worth writing down your setting for future reference.

4 READING FRONT FORK SAG

Use this same format for adjusting the sag on the front fork, except this time stand out of the saddle in your 'trail attack' position to take the measurement. Again, be careful not to disturb the marker when dismounting. Repeat steps 2 and 3 to correctly set fork sag.

COMPRESSION

Adjusting settings to match your ride

On most bikes compression damping will be a low-speed adjustment, meaning you can adjust how sensitive the bike is to small bumps and rider movement. More damping will offer a firmer ride and less pedalling-induced 'bob', whereas less adjustment will have more bob but a plusher ride.

There isn't a right or wrong as far as setting this adjustment goes, as long as you understand what its function is. Dial in more damping for those smoother stretches, like commuting, and then wind it out for off-road action. Certain shocks have lock-out levers, and specific levers to engage this kind of damping.

High-speed damping is a different kettle of fish. This is the damping that the shock uses when the shaft is forced to move at speed, through a succession of big bumps or during hard landings.

With not enough high-speed damping, you'll blow through the travel, while too much will leave the unit feeling harsh. The best way to set this up is by starting with it wound out, and then riding a familiar rough section of trail. If you're using all the travel too easily, add a couple of clicks of compression. Most fork and shock manufacturers have recommended base settings, so check your manuals. However, there is nothing like trial and error to discover the settings that suit you, your riding style and the terrain you ride.

REBOUND

Bringing the fork back for the next hit

Controlling the rate at which the fork or shock returns after compression, rebound damping is often set up poorly in favour of a bike that feels good in the car park.

A good base setting would be to dial enough rebound for the bike to not feel bouncy, and then add a couple of clicks. More rebound is definitely better so that the bike can absorb hard hits. With minimal damping the bike will feel nice over the small ripples, but will kick you up the arse when you hit a stubborn root or plough through a rock garden at speed.

Like compression adjustments, you really need to try your settings on a familiar rough section of trail. If the bike is kicking you then you don't have enough rebound, and if it feels 'dead' the shock will be packing down and you have too much damping.

Again, many manufacturer manuals will offer base settings to get you going. On a full-sus bike it's wise to set up both ends in a similar way so there is little marked difference in the way they react to obstacles.

SHOCKS

Fine-tuning your rear suspension

SPRING PRELOAD

This is the load applied to a spring – by adjusting the spring retaining ring – to achieve the correct sag. Six turns is the maximum you should tighten the ring to achieve your correct sag. If you need more than this then you'll need to go up in spring rate.

AIR SPRING

Like on a suspension fork, a chamber holding air provides the spring.

COMPRESSION

Due to the progressive nature of air shocks, various different compression options exist to tame big-hit progressiveness and to combat the issue of rider-induced movement.

COMMON VARIATIONS

ProPedal – Fox
The multi-position adjustable low-speed compression circuit, designed to improve pedalling efficiency.

Bottom-out resistance – Fox/ Marzocchi
A single air valve that adds progression to the end of the stroke – on air shocks and long-travel coil shocks.

TST (Trail Selection Technology) – Marzocchi
Adjustable low-speed compression to increase pedalling performance.

SPV (Stable Platform Valve) – Manitou
The externally adjustable pedalling platform resists rider movement, and a separate air volume adjuster controls the progression of the shock.

High-speed compression
A simple adjustment that only affects the compression damping at high shaft speeds, such as big impacts.

Low-speed compression
This adjustment controls the low shaft speed movements and can be used to counter some rider inputs such as weight shifting and pedalling.

REBOUND

This refers to the force of the shock returning from a compressed state, and the way it's damped to control the speed.

COMMON VARIATIONS

Low-speed rebound –Cane Creek
This controls how the shock extends at low shaft speeds, ensuring traction over trail chatter and stutter bumps.

High-speed rebound – Cane Creek
This controls how the shock extends at high shaft speeds, helping to prevent bucking after a big hit.

Dual Flow – RockShox
Independent damping circuits for the beginning and end of the stroke to alter the ride on small and big hits. The end-of-stroke adjustment is factory set, but the beginning is easily rider adjustable.

End-stroke rebound – RockShox Vivid
End-stroke rebound controls the second part of the stroke, for example after a big hit.

Beginning stroke rebound – RockShox Vivid
The control of rebound in the first part of the stroke to resist rider movement and small impacts.

LOCK-OUT / LOW-SPEED COMPRESSION
A damping circuit that resists compression from low-speed inputs like pedalling forces

REBOUND
Controls the rate at which the shock extends after compression

SHAFT
The visible part of the piston that compresses the air spring

AIR VALVE
Port for adding or removing air pressure

BODY
Airtight can that contains compressed air acting as a spring

TYPICAL REAR SUSPENSION DESIGNS

From single pivot to swing link

There are many rear suspension designs out there, and they all offer slightly different traits. Some feel plusher than others, but the plush feel can desensitise your riding. Frames that feel firmer often feel faster and livelier.

Some designs, such as single pivots, can have more flex than other bikes, but despite what you may think some flex is good because the bike can contort slightly through rough terrain.

Designs using cartridge bearings may be ultra plush, but they also carry a weight penalty – bushings can be as efficient and weigh less, so they have their place.

It can be tricky getting the right bike for you, and often you won't know until you've ridden another bike against your own.

Here are the main types and the traits of each style.

ABP/FULL FLOATER

ABP (Active Braking Pivot) is Trek's latest platform, and can be seen from its 4in travel cross-country (XC) bikes through to its 8in travel downhill (DH) race bikes. The shock is isolated from the front triangle and is actuated by both the chainstay- activated and the seatstay- activated rocker. This offers an incredibly plush ride in all conditions.

SINGLE PIVOT

A classic design that's very simple and light. A lower pivot will mean a more active feel, and less pedalling-related bob. A higher pivot tends to have a better suspension action as it allows the axle to move in a rearward path, but suffers from pedal-induced movement.

FOUR BAR/HORST LINK

Using the Horst Link, which is situated on the chainstay, this is a true four-bar design and is famous for its very plush ride, and its action is minimally affected by braking. Specialized owns the patent on the link, but many other brands pay for the licence to use it.

HIGH PIVOT

On paper, a high pivot offers the best suspension action due to the active rearward axle path, which lets bikes plough through square-edge hits – the type of bump that either bucks your wheel into the air or stalls the wheel. Both GT and Mongoose have high pivot bikes with independent drivetrains, isolating pedalling action from suspension action.

SINGLE PIVOT, LINKAGE ACTIVATED

With the simplicity of a low single pivot, these bikes use a linkage to tune the leverage ratios under compression. By using a longer stroke shock, an extremely compliant and plush action can be more easily achieved.

VPP

The Virtual Pivot Point was developed by Outland Cycles in the early Nineties, but has been refined by Santa Cruz and Intense Cycles. Twin linkages separate the rear triangle from the front, and allow a certain wheel path that uses chain tension to tame bobbing in the rear end, but allows active wheel travel while pedalling.

FLOATING LINKAGE

Again resembling the VPP design, twin links are used by many manufacturers, all offering slightly different characteristics. Some designs work on pedalling efficiency while others focus on bump absorbing efficiency.

FAUX BAR

A single pivot, linkage activated design that's popular for its very strong and torsionally stiff design. Often mistaken for Four Bar designs that use a pivot between the main pivot and wheel axle.

DW LINK

Like the VPP, twin links isolate the rear end, but the axle path and characteristics differ from the VPP system. The DW Link allows a slightly extending chainstay length that counters the pedalling effect through the whole range of gears, so it remains active all the time.

SWING LINK

Refers to a linkage, usually mounted on the top tube between the seatstay and the shock. This link can be used to both stiffen the rear end and to add progression to the shock's action. Bikes featuring a swing link can be VPP designs, or alternatively low pivot, Horst Link designs like this Lapierre.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

60 mins

Free

SETTING UP YOUR AIR FORK

Getting your air suspension fork properly set up will ensure maximum ride comfort, control and enjoyment. Here's how to get it right

1 LOCATE AIR VALVE

Most forks these days use air as the main spring. Air is light, easy to work with and, for the time being at least, free. Most modern suspension forks have at least one externally adjustable feature, typically the air chamber. This is usually accessed through a Schrader air valve which will normally be hiding under a protective cap on the top of the left fork leg. Adding air to the chamber makes the fork firmer and releasing it makes the fork softer.

5 RESPRING THE FORK

To get the fork back to its original state, use an air pump that you know to be accurate and add air to the main chamber, using the manufacturer's guidelines as a starting point. They are often based on rider weight (your weight with all your riding kit on), and are specific. If you don't know your exact weight, then weigh yourself on some accurate scales — no fibbing or guessing, please!

6 KNOW YOUR NUMBERS

Knowing the total travel available allows you to understand what differences the changes you're making to the fork are actually having. Make a written note (you won't remember) of the total travel available, your weight and the exact pressure applied to the air chambers. This will allow for a faster set-up next time around and make detail changes accurate.

TIP

Once you've completed the set-up process, remove the zip tie as grit can get behind it and damage the anodised finish of the stanchion.

7 ADD A ZIP TIE

If there isn't an O-ring on one of the fork stanchions, put a plastic zip tie on. This will give you a running guide to the total travel achieved on any given ride or portion of ride. Use a thin zip tie and do it up tight, so it can't slip back down unless you do it by hand (it won't affect the performance of the fork). Trim off the excess with a sharp blade, taking care that you don't mark the fork's delicate anodised finish.

11 SPRING RATE

Air has a linear spring rate — changing the air pressure changes the firmness of the fork, but doesn't alter the spring rate curve, which will remain linear. To increase the spring rate and stop the fork from blowing through its travel (a common air fork trait), you may need to add a little oil into the lower leg containing the air spring. Refer to our Top Tips panel above for Manitou forks, or take your fork to a dealer for all other brands.

12 REBOUND ADJUSTMENT

Some forks have external rebound damping adjustment. This controls the speed at which the fork extends to full travel after compressing for a hit. Begin with the adjustment all the way off. This will allow the fork to re-extend to its full length at maximum speed. Add rebound one click at a time, and keep adding rebound damping until you feel that the fork re-extends quickly but without jolting or 'packing down'.

13 COMPRESSION DAMPING ADJUSTMENT

Some forks are quite sticky from new and require as little resistance to compression as possible. As the action frees up you can add more compression damping. Most XC-orientated riders like a fork that rides slightly higher in the travel and is less liable to rider-induced movement, so it's better to err on the side of more rather than less compression damping.

- ✓ Shock pump
- ✓ Tape measure
- ✓ Zip ties
- ✓ Fork manual
- ✓ Lint-free cloth

WORKSHOP WISDOM

Manitou forks are designed to be run 'wet'. Periodically undo the 8mm Allen bolt on the bottom of the right leg, drain the oil in there and replace with 16cc of suspension oil (refer to your user manual for how to do this). This is what keeps the fork action running smoothly and protecting the action, so don't forget to do it.

TIP

Give the fork a thorough clean. Even small amounts of dirt in seals or in the stanchions can cause the action of the fork to be impaired. A simple regular wipe-down with a lint-free cloth is enough to keep it healthy.

2 RELEASE THE AIR

Remove the spring medium from the fork and fully compress it. This usually means releasing the air from the main air chamber via the Schrader valve. Depending on the make and model of fork, you may also need to remove air from a secondary air chamber. Be careful not to have your face over or near the valve when you release the air from the fork, because occasionally a little oil can be sprayed out, and it's not good for the peepers.

3 EXTEND THE FORK

Allow the fork to return to its fully extended position. There should be a fine oil line left at the upper end of the stanchions where the wiper seals have just been – this shows the maximum travel available to the fork. If the fork hasn't left a small oil ring on the stanchion, this may signal that your lip/wiper seals are dry. Simply drop a little light oil on the clean fork seals and massage it in by gently easing the seals back with a fingernail.

4 CHECK TOTAL TRAVEL

Measure from the fork wiper seal to the oil line that has been left on the stanchion. Alternatively, use a zip tie on the stanchion to use as the travel tidemark. This figure is your fork's total travel. It may differ from the manufacturer's claim by a few millimetres, though most are fairly accurate about their travel claims. RockShox prints the travel on the stanchions of some of its forks as a useful guide.

8 WORK OUT THE SAG

In order to let the front wheel 'track' the surface of the ground, we allow some of the travel of the fork to be used when supporting the rider's static weight — this is called sag. The idea is to have around 25% of your bike's total travel as sag. To work out sag, divide the total travel by 100, then multiply this by the required sag (in this case, 25). For a 120mm travel fork this is: 120 divided by 100 = 1.2. Multiply 1.2 by 25 = 30. So the required sag is 30mm.

9 ADJUST THE SAG

Sit on the bike and then ease off the saddle, trying not to 'bounce' the suspension as you get on and off. The zip tie you fitted will ride up the stanchion and show you the level of sag you have running. Add or subtract air using a shock pump to dial in the sag until you reach the 'optimum' 25% setting. Correctly adjusted, you should bottom the fork once or twice per ride. As little as 5psi can be the difference between lethargic action and a taut, lively ride.

10 NEGATIVE AIR

On some forks (Marzocchi and RockShox) there is a negative air chamber, used to add progression to the end of the spring rate and counter the tendency for harsh bottoming. Some models automatically fill this chamber as you add air in the main chamber, while others have a separate valve. On separate-valve models, don't add too much — you want to bottom-out the fork, but only on hits of a certain size/severity.

14 LOCK-OUT BLOW-OFF

Occasionally suspension forks have a lock-out facility. This allows the rider to cause the fork to remain at its full fixed length, simply by turning a dial on the fork leg or flicking a bar-mounted switch. This is handy to use on smooth roads or climbs. You can occasionally adjust the blow-off settings for this feature, ensuring that the fork will begin working as normal should you hit an obstacle while riding locked out.

15 PEDAL PLATFORM

'Pedal platform' is a way of controlling the action of the suspension so that it distinguishes between rider inputs (and doesn't react to them) and terrain inputs (and does react to them). Manitou's SPV valves and RockShox's Floodgate control help improve pedalling efficiency. For SPV valves, use your shock pump to add air into the SPV chamber, up to 150psi. The system works best around 40psi, but if you want a firm feel then add more air.

16 THRESHOLD

RockShox's Floodgate threshold allows you to control the platform effect from almost fully open to fully locked. The Motion Control threshold is adjusted via the gold adjuster in the top cap. First, engage the platform by turning the blue lever to the lock position. You can adjust the 'gate' or threshold of the Motion Control by turning it positively for more threshold and a firmer ride, or negatively for less and a more active ride.

OFF-ROAD

BEGINNER

40 mins

Free

SETTING UP YOUR AIR REAR SUSPENSION

Save time and money by following our indispensable guide to getting the plushest, most predictable performance from your rear shock

1 LOCATE AIR VALVE

Air shocks are the best choice for general purpose cross-country and all-mountain style riding. Air shocks require air to be added to the spring, and this is done via a Schrader valve fitting that's found on the shock body. Before you think about adding any air, you should first remove the air from the shock and fully compress it. This will show you the total available travel of your particular rear shock.

5 KNOW YOUR NUMBERS

Knowing the total travel available allows you to understand what differences the changes you're making to the shock are actually having. Make a written note of the total travel available, your weight and the exact pressure applied to the air chambers. This will allow for a faster set-up process the next time around and make detailed changes super accurate.

6 ADD AIR

A good rule of thumb for inflating air shocks is to add 1psi of air for every pound you weigh. Therefore if you weigh 140lb, then begin the set-up process at 140psi. Remember to use an accurate shock pump, as old pumps often have leaks and faulty pressure dials. If you're only guessing at the changes you're making, it'll take a lot longer to nail the settings you need. Check your shock manufacturer's manual for precise guidance.

7 UNDERSTAND SAG

In order to let the rear wheel 'track' the surface of the ground, we allow some of the rear-wheel travel to be used when supporting the rider's static weight: this is called 'sag'. The basic idea here is to have around 25% of your bike's total travel as sag. This allows the rear wheel to drop into dips and holes while maintaining contact and traction. Remember the rear wheel isn't working in isolation, so the front and rear wheel sag should match.

11 SPRING RATE

Air has a linear spring rate, and changing the air pressure changes the firmness of the shock but doesn't alter the spring rate curve, which will remain (relatively) linear. To make the shock firmer, add air. If the shock feels about the right firmness, but is being activated by the frame's transmission, switch on the ProPedal lever (if your Fox shock has one). This will allow you to ride with a supple rear suspension, but will dial out the shock movement.

12 COIL SHOCKS

Coil shocks use coiled metal as a spring, instead of air. If you're over or under the desired sag level, you should definitely swap out the spring for a heavier/lighter version (most shops carry a few spares for swapping on new bikes, so don't be afraid to ask them for help). Don't be tempted to fix coil spring rate issues with preload. This is a ride height adjustment, so again refer to your shock manufacturer's manual for precise set-up advice.

13 REBOUND ADJUSTMENT

Some shocks have external rebound damping adjustment (normally a small red anodised knob). This adjustment controls the rate at which the spring's energy is delivered back to the rider. Too little and the rider will get a jolt though the saddle after each hit; too much and the shock won't extend to its full length in time for the next impact, potentially causing it to 'pack down', losing available travel with each hit.

- ✓ Shock pump
- ✓ Tape measure
- ✓ Zip ties
- ✓ Shock manual

WORKSHOP WISDOM

When you've got the front and rear suspension set up, ride along and stand up with your pedals level and your weight squarely between the wheels. Now squash the bike into the floor. The front and rear suspension should compress and return at the same rate. Use the reflection from a shop window to check: the front triangle of the frame should remain level through compression and rebound strokes.
Check the mounting hardware for wear and adjustment at regular intervals. Worn bushes, bent mounting bolts or loose nuts will only serve to reduce shock performance and (much worse) potentially cause permanent damage to your frame's shock fixing points.
It really is worth taking the time out to check the mounting hardware regularly, as it will potentially save you some serious money in the long run.

2 ADD ZIP TIE

Fit a zip tie around the shaft of the rear shock. Make sure it's tight: it won't harm the performance of the rear shock, and will stop it moving from vibrations. The zip tie will show you the maximum travel you get during every ride (remember to slide it back to the lip seals to reset it before the ride), and you'll know at a glance whether everything is working as it should. Air loss is rare, but can happen over time, and this will help spot it.

3 EXTEND THE SHOCK

Fully extend the rear shock and measure the distance between the lip seal and the oil ring to get the figure for the shock's total travel. Check this figure against that given by the manufacturer. Remember that 40mm of shaft travel doesn't mean your bike has 40mm of rear travel: the frame it's fitted to will convert that 40mm into anything from 80-140mm of rear-wheel travel, depending on the linkage used between the shock and frame.

4 ADD AIR

Respring the shock. To get the shock back to its original state, use an air pump that you know to be accurate, and add air to the main chamber using the manufacturer's guidelines as a starting point. These are often based on rider weight, and are specific. If you don't know your exact weight, then weigh yourself on some accurate scales.

8 CHECK SAG LEVEL

When you've added the equivalent of your bodyweight (measured in pounds) in psi, carefully sit on the bike and then ease off the saddle, being careful not to bounce the rear suspension as you get on and off. It's often easier to do this with the help of a second person to steady the bike. The zip tie you fitted earlier will ride up the shaft and show you the level of sag you have.

9 ADJUST SAG LEVEL

Add or remove air to dial in the sag until you reach the 'optimum' 25 per cent sag setting. Correctly adjusted, you should bottom the shock once or twice per ride (on suitably big hits). The difference of even 5psi in some shocks can make a big difference in ride feel. Spend some time sorting sag (some riders like more or less than 25 per cent, depending on individual riding style and terrain).

10 NEGATIVE AIR

On some rear shocks there is also a negative air chamber, and this is used to add progression to the end of the spring rate and counter the tendency for harsh bottoming-out. Some models automatically fill this chamber as you add air in the main chamber, while others have a separate valve. On separate valve models, don't add too much: you want the shock to bottom out, but only on hits of a certain size.

14 SETTING REBOUND

Begin with rebound damping off (turn the knob towards the minus arrow). This will allow the shock to re-extend to its full length at maximum speed. Usually this is too fast for most riders, though very light riders may find it acceptable. Add rebound one click at a time and ride through some typical trail sections. Keep adding rebound until you feel the suspension extends quickly bu

15 COMPRESSION DAMPING

Occasionally air shocks also have a blue dial or switch (other than the ProPedal lever we mentioned in step 11). This is a compression damping adjuster, controlling the rate at which the spring is allowed to compress under a given load. Begin adjustment in the fully off position (no compression damping), adding a click before testing the effect and deciding if more is needed.

16 LOCK-OUT

Some air rear shocks also have a lock-out facility. This allows the rider, at the flick of a remote bar-mounted switch or turn of a shock-top dial, to cause the shock to remain at its full fixed length. This is handy to use on the road or for long, smooth climbs. Most rear shocks with a lock-out option have a blow-off feature, which ensures that the shock will begin working as normal should you hit an obstacle while riding locked out.

OFF-ROAD

ROAD

BEGINNER

EXPERIENCED

EXPERT

60 mins

£15-35 for fork springs
£20-50 for a shock spring

DOWNHILL SUSPENSION

FORK SET-UP

This insight into the black art of tuning long-travel suspension will help you squeeze every last ounce of performance from your fork

1 CHECKING FORK SAG

Move the O-ring around your stanchion down so it's sitting on the dust seal. If you have no O-ring, loosely fit a zip-tie to the fork. Mount your bike fully kitted up and get into an aggressive riding position. You should be using around 25-30% of your fork's total travel as sag. If you're using too much or too little of your fork's travel, a change of coil spring is needed.

2 ADJUSTING PRELOAD

The preload adjuster on the top of the left leg compresses the spring and changes the fork's feel. Wind it clockwise to make the spring feel harder or anti-clockwise to soften it up. If you can't sort out your sag issues with this, you'll need to change your coil spring.

3 CHANGING COIL SPRING

To change your coil spring, remove the left leg's top cap keeping any spacers underneath it in order, before pulling out the coil spring. Most are colour coded to indicate their spring weight, which helps identify you're making the right change. Pop the new spring in, refit any spacers and torque the top cap to the manufacturer's recommended torque setting.

4 ADJUSTING AIR SPRING

Remove the air adjust cap from the top of the left-hand leg. Screw the shock pump onto the valve until the pressure registers on the pump, then screw on another quarter turn. Note the air pressure, inflate or deflate, and note the pressure again. Remove the shock pump and measure your sag. Repeat until you're satisfied with your sag measurement.

5 REBOUND 1

Locate the rebound adjuster on your fork, usually red in colour. On both Fox and RockShox forks it's located at the bottom of the right-hand leg. Turning the adjuster clockwise will increase rebound damping, making your fork return more slowly. Turning the adjuster anti-clockwise will decrease rebound damping, speeding up the return phase.

6 REBOUND 2

Push down on the fork with all of your weight and let it spring back. If you can lift the front wheel high off the floor before the fork extends it has too much rebound and is too slow. If you feel the fork trying to push you away and you can't lift the wheel off the floor, it's too fast. Experiment with settings on the trail to find what you prefer.

7 COMPRESSION

Locate your fork's compression adjuster/s. They're normally found on the top of the right-hand leg. Compression damping determines how fast the fork can compress when hitting an obstacle or bump. More compression damping and the fork will be less sensitive to small bumps, less and it will be more prone to falling through its travel and feel mushy.

8 LOW-SPEED COMPRESSION

If you have a separate low-speed compression adjuster, it affects how the fork behaves at lower shaft speeds, like when pedalling or compressions into berms. Too much low-speed compression damping and the front wheel will tend to deflect off objects easily. Too little and the suspension will dive, using more travel than it needs to.

9 HIGH-SPEED COMPRESSION

High-speed compression damping affects higher shaft speeds such as hard landings, square-edge hits and G-outs. Too much high-speed compression damping and the fork will give a rough ride and feel too hard. Too little and the fork will dive through the travel easily and feel out of control in rough sections.

✓ Shock pump (if you have an air or air assist fork)
✓ tape measure
✓ zip ties

DOWNHILL SUSPENSION

SHOCK SET-UP

A mile of suspension travel is worthless without a well tuned shock. We show you how to get the best from yours

1 SETTING UP SAG 1

Sit on your bike fully kitted up in riding gear. Get a mate to measure the shock's compressed eye-to-eye length while you're sitting on it. Subtract the compressed (sagged) measurement from the total eye-to-eye shock length. This is your sag in mm.

2 SETTING UP SAG 2

You need to know your shock stroke to calculate your sag percentage; it's written in the shock's user manual. Divide the sag measurement (mm) by the shock stroke and multiply it by 100 to get the sag percentage. For downhill we'd recommend 35%. Alter spring preload by up to two turns or switch the spring to achieve optimal sag. If using air, add or remove as necessary.

3 SETTING REBOUND 1

The rebound adjuster may be marked + and –. Turning the adjuster clockwise in the + direction will give more (and therefore slower) rebound damping, and turning the rebound adjuster in the – direction will give you less (faster) rebound damping.

4 SETTING REBOUND 2

To check rebound, push down on the rear of the bike and let it spring back. If you can lift the rear wheel high off the floor before the rear shock extends, it has too much rebound (so is too slow). If you feel the bike trying to push you away and you can't lift the wheel off the floor, it hasn't got enough rebound (so is too fast). Experiment until you find a happy medium. If in doubt, it is best to set the rebound on the slow side.

5 COMPRESSION

Locate your shock's compression adjuster/s. Compression damping determines how fast the shock can compress when hitting an obstacle or bump. More compression damping and the shock will be less sensitive to small bumps, less and it will be more prone to falling through its travel and will feel horribly mushy.

6 LOW-SPEED COMPRESSION

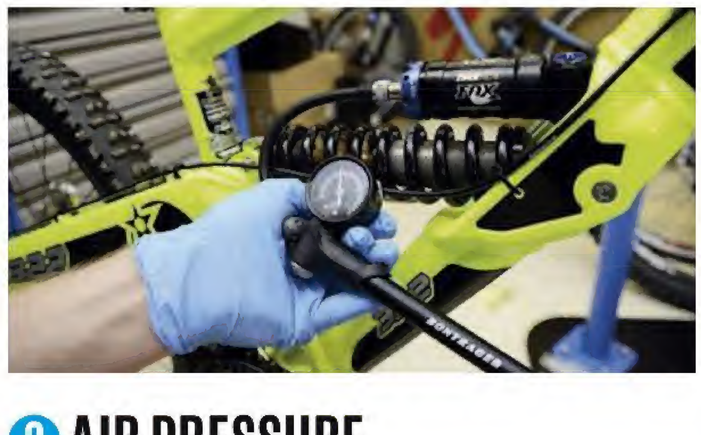
If you have a separate low-speed compression adjuster, it affects how the shock behaves at lower shaft speeds, like when pedalling or compressions into berms. Too much low-speed compression damping and the rear wheel will tend to deflect off objects easily. Too little and the suspension will dive, using more travel than it needs to.

7 HIGH-SPEED COMPRESSION

High-speed compression damping affects higher shaft speeds such as hard landings, square-edge hits and G-outs. Too much high-speed compression damping and the shock will give a rough ride and feel too hard. Too little and the shock will dive through the travel easily and feel out of control in rough sections.

8 BOTTOM-OUT RESISTANCE

If your shock has a bottom-out resistance adjuster, it'll affect the last part of the travel, much like the air pressure. If you're finding yourself bottoming out all the time, try winding it on a quarter turn at a time. It's best to start at the minimum and add more slowly until you find the optimum setting for you.



9 AIR PRESSURE

If your shock has adjustable air pressure on the reservoir, it'll affect the shock toward the end of the travel, making it harder to bottom-out. Too much air pressure though, and you'll find that you're not using enough of the travel and have a harsh ride. Too little and you'll be bottoming-out too often.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

45 mins

£10 (5 Float Fluid pillow packs)

FOX 34 FOAM RING RE-LUBE

It's often overlooked, but a simple re-lube doesn't take long and can transform the feel of your fork. Here's how to do it...

1 CLEAN YOUR BIKE

Clean your bike. Pay particular attention to the fork, using a rag and some degreaser to make sure it's as close to spotless as it can be. Any dirt left around the wiper seals, arch or stanchions could potentially contaminate the internals. Make a note of the air pressure and the number of clicks of rebound damping you've been using.

5 THREAD FOOT NUTS

With the crush washers removed, loosely thread the foot nuts back on to the threads protruding from the bottom of the fork. Thread them on so the top of the thread is level with the top of the nut. Sit the socket on top of the nut. Use a plastic mallet to give it a sharp tap downwards. Now remove the foot nuts again and put them safely to one side.

6 REMOVE LOWERS

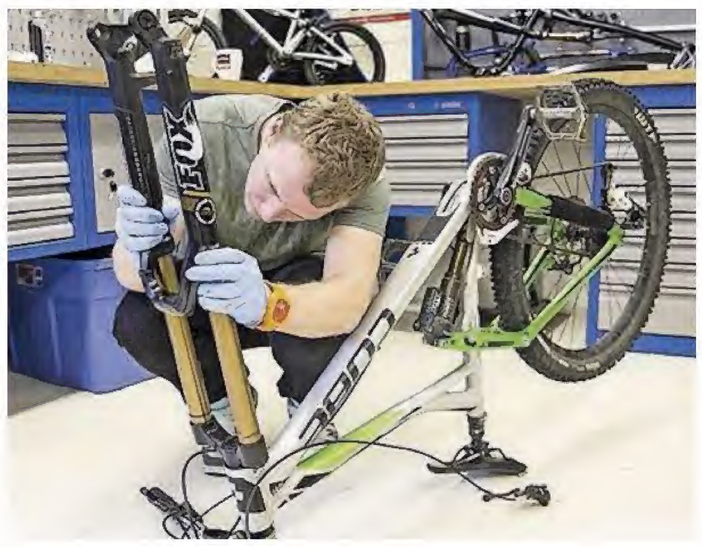
To remove the fork lowers, hold the fork at the crown with one hand and the lowers with the other, then gently pull the lowers up away from the crown. Try wiggling them upwards if they feel stuck. Once they're free, pull the lower legs up and off over the damper rods. Have some rags ready when you do this, because oil is likely to drip out.

7 WIPE SEALS

Make sure your bike isn't going to tip over – there's fork oil inside the upside-down stanchions! Now it's time to concentrate on the lowers. Use a little fork oil (the thinner, the better) on a clean rag to give the lip of the wiper seals a wipe. You have to be super-careful and as gentle as possible doing this so you don't damage the seals in any way.

11 LUBRICATE

Take a pillow pack of Fox Float Fluid and carefully drip the lubricant on to the first foam ring. With a finger, spread the fluid around the ring as evenly as possible to ensure it's coated sufficiently. Repeat this on the other ring. You should use about one pillow pack per ring, making sure they're totally saturated with Float Fluid.



12 REFIT LOWERS

Now to refit the lowers. Carefully line the lowers up with the damper rods, before sliding them down into place so the seals meet flush with the bottom of the stanchions. It's important not to damage the inner lip of the wiper seals. Slide the lowers down the stanchions until the damper rods' threads are protruding through the bottom of the lowers again.

13 REFIT ADJUSTERS

Refit the crush washers, or replace them with new ones. Screw the foot nuts on to the protruding threads and tighten them with their respective sockets to 5.6Nm. Now refit the rebound adjuster. The grub screw sits in a recess on the protruding pin. Line it up, then sit the adjuster in place and tighten the grub screw to 1.2Nm.

- ✓ Fox Float Fluid
- ✓ Clean rags
- ✓ 10mm & 15mm sockets
- ✓ Socket wrench
- ✓ Torque wrench
- ✓ 2mm, 2.5mm & 5mm Allen keys
- ✓ Small ball-ended Allen key
- ✓ Plastic mallet, degreaser
- ✓ Light fork oil (about 5wt)

WORKSHOP WISDOM

It always pays to keep notes on your suspension set-up and service intervals. It's easy for time to fly by and to think you're not due a lower leg lube when in fact your fork is stickier than flypaper!

Keep a note of your air pressure, rebound settings and compression settings (if you have the adjustment available). You may not need to refer to these notes often, but you'll be glad you've got them when your fork just isn't feeling right.

2 REMOVE WHEEL

Flip the bike upside down so it's resting on the bar and saddle. Remove the front wheel. Use a 2.5mm Allen key to unscrew the brake hose guide from the fork lowers, turning it anticlockwise. Then use a 5mm Allen key to remove the brake calliper, again turning it anticlockwise. Stow the calliper somewhere out of the way of the fork.

3 LOOSE GRUB SCREW

Use a 2mm Allen key to loosen the grub screw on the red rebound adjuster at the bottom of the right-hand fork leg, turning it anticlockwise until the rebound knob can be removed. Put the rebound adjuster with the screw still attached somewhere safe. Give the area where the rebound adjuster attaches a quick wipe with a clean rag.

4 REMOVE NUT

Remove the foot nut from the fork's right-hand leg using a 15mm socket, turning it anticlockwise. Remove the foot nut from the fork's left-hand leg with a 10mm socket. There will be black plastic washers (crush washers) left in a recess in the foot nuts or on the thread that's protruding from the bottom of the fork leg. Gently remove the washers (ideally use new ones to refit).

8 REMOVE RING

Using a clean, small, blunt object such as the ball end of an Allen key or a blunt old spoke, gently hook the foam ring out from below the left-hand wiper seal. These foam rings are fragile, so be careful to make no sudden movements and make sure your tool isn't going to tear the ring. Now remove the ring from the other leg and sit both rings on a clean rag.

9 CLEAN RINGS

With any luck, the foam rings will be clean, if a little discoloured. If they're dark brown, sticky or have any lumps stuck in them, you'll need to replace your fork oil – you can find instructions on the Fox website for this procedure. Carefully clean the foam rings with the thin fork oil – cover each ring in oil, then squeeze it out until the rings are clean.

10 REFIT RINGS

Once the rings are clean, you can refit them in the fork. It's easiest to gently fold each ring so it can be slotted through the wiper seal where you can get one edge seated in its recess. Work carefully around the first foam ring with your finger until it's seated neatly into its recess and isn't folded or twisted in any way. Repeat this with the other foam ring.

14 REFIT BRAKE HOSE

Fit the calliper back on the brake mount using the 5mm Allen key. Nip the bolts up, then undo them half a turn so the calliper can be aligned correctly later. Now refit the brake hose guide to the fork lowers, being careful to thread the bolt in straight and only tighten to 0.9Nm. Refit the wheel and turn the bike over so it's the right way up.

15 TIGHTEN CALLIPER

Holding the front brake lever to lock the front wheel, tighten the calliper to 10.1Nm with the 5mm Allen key. Release the lever and spin the wheel to check the alignment. Give the fork a cycle through its travel. If it doesn't feel smooth after a few cycles, instead feeling stiff and sticky, chances are that one of the foam rings has moved, folded over or become dislodged.

16 CHECK FORK PRESSURE

Now that your fork feels smoother, you may need to increase the air spring pressure to compensate. Working off the settings you noted at the beginning, check your fork's air pressure and the number of clicks of rebound damping and adjust as necessary. Once you're happy with your set-up, go out and ride, and enjoy your super-plush-feeling fork.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

30 mins

£12.99 for Bottomless Tokens (fork), £13.99 for Bottomless Rings (shock)

HOW TO FIT ROCKSHOX VOLUME SPACERS

Want to adjust the spring curve of your Pike fork or Monarch DebonAir or High Volume shock? Here's how...

ROCKSHOX PIKE FORK

1 NOTE FORK PRESSURE

Ensure the bike is clean, so no dirt can fall into the fork. It's also best to have the bike in a workstand. Remove the air valve dust cap from the top of the non-driveside fork leg, turning it anticlockwise with your fingers, and put it somewhere safe. Attach a shock pump to the Schrader valve and take a note of the air pressure.

4B REMOVE TOKENS

For a more linear feel, use an 8mm Allen key and 24mm socket to unscrew (anticlockwise) one or more Bottomless Tokens from the base of the air cap. Set them aside and ensure that any remaining tokens are tightened to 1.1-2.3Nm with the 8mm Allen key and 24mm socket.

5 REINSTALL AIR CAP

Apply suspension grease to the air cap O-ring and reinstall the air cap in the fork. Using the 24mm socket, turn the air cap clockwise by hand as far as you can, taking care not to cross-thread it. Then attach a socket wrench and tighten the air cap to 28Nm while applying downward pressure on to the socket to avoid rounding the nut.

6 ADD AIR AND CHECK

Attach the shock pump to the valve and reinflate the air spring to your desired pressure. Remove the pump, release the bike from the workstand and check the fork's sag. Adding or removing Bottomless Tokens will change the sag slightly for a given pressure so you may need to add or remove pressure to achieve the same sag as before. Reinstall the air valve cap.

10 REMOVE O-RING

Now to remove the retaining O-ring from the DebonAir/High Volume sleeve. Pinch the O-ring with your index finger and thumb to create a loose/baggy area, then with your other hand carefully grasp the exposed portion of O-ring and slide it down and off of the air sleeve. Put it somewhere clean and safe.

11 REMOVE SLEEVE

Clamp the shock eyelet hardware at the air can end of the shock in a soft-jawed vice. Grip the DebonAir/High Volume sleeve with your hands and pull firmly down over the shock shaft to remove it. Put the sleeve somewhere clean and safe.

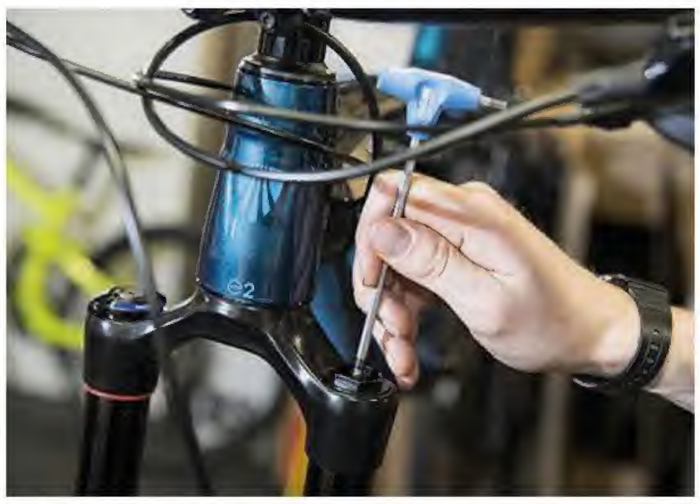
12 ADD RINGS

Slide the required number of Bottomless Rings on to the air can so they're lined up above the rib in the middle of the can. Check the SRAM website to find out the maximum number that can be fitted to your shock, and make sure not to exceed this.

- ✓ Shock pump
- ✓ Suspension grease
- ✓ Rags or cloth
- ✓ Torque wrench
- ✓ Allen key set
- ✓ Socket wrench
- ✓ 24mm socket
- ✓ Bottomless Tokens
- ✓ Bottomless Rings
- ✓ Soft-jawed vice

WORKSHOP WISDOM

Removing the air cap from the top of a fork can be a tense procedure. Most sockets are internally chamfered and that can make it difficult to get a good purchase on the shallow, alloy nut on the air cap. If you're not careful it's easy to round it off, making it very difficult to remove. To prevent this, it's worth trying to get hold of a ground-flat socket from a bike shop or hardware store. These aren't internally chamfered so they get a better purchase on the nut and are much less likely to damage it. They're as rare as hen's teeth though!



2 REMOVE THE AIR

Release all the air from the spring using the bleed button on the shock pump. Remove the pump and press a ball-ended Allen key – or similar narrow object – into the valve to release any air that may still remain.

3 REMOVE AIR CAP

Now you'll need to use a 24mm socket and wrench to unscrew the air cap on the top of the non-driveside fork leg. Ensure the socket is engaged securely, then turn the wrench anticlockwise, holding the fork with your other hand to keep it steady. Remove the air cap from the fork. If there are any red Bottomless Tokens already fitted, they'll be screwed into this.

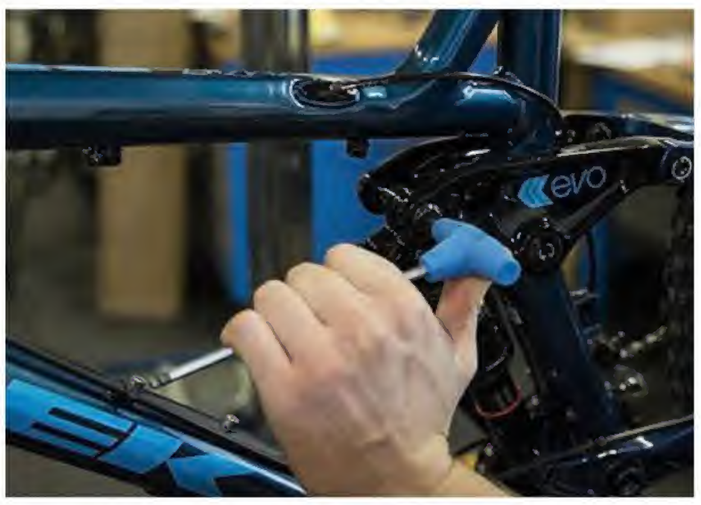
4A ADD TOKENS

For a more progressive spring rate, add one or more tokens by screwing them clockwise into the air cap. Use an 8mm Allen key and 24mm socket to tighten them until gently snug (1.1-2.3Nm). Don't exceed the maximum number of tokens for your fork. The 140-160mm travel Pike in 26in, 650b and 29in takes a maximum of four Bottomless Tokens, for example.

ROCKSHOX MONARCH DEBONAIR OR HV SHOCK

7 NOTE SHOCK PRESSURE

Clean the bike and, if possible, clamp it in a workstand. Remove the air valve dust cap from the shock. Attach a shock pump to the valve and take a note of the air pressure. Release all the air from the spring using the bleed button on the shock pump. Remove the pump and press a ball-ended Allen key – or similar object – into the valve to release any air that may remain.



8 REMOVE SHOCK

Now to remove the shock from the bike. Take up the weight of the rear wheel with one hand while using the required Allen key(s) for your frame to turn the shock mounting bolts anticlockwise with the other. Remove the bolts and set them aside somewhere safe. Clean the shock, to prevent damage or contamination during disassembly.

9 REMOVE HARDWARE

If the mounting hardware on the shaft eyelet is wider than the damper shaft itself, it must be removed. First remove the spacers from the ends of the bushing pin by hand. To remove the bushing pin from the eyelet, first try to push it out with your thumb. If it's reluctant to move by hand, check the SRAM website for a detailed guide on how to remove it.

13 REINSTALL SLEEVE

Now to reinstall the DebonAir/High Volume sleeve. With the shock clamped in the vice, slide the sleeve over the air can and Bottomless Rings, and push it firmly into place. Lightly grease the retention O-ring, then slide it over the shock shaft and roll it into the groove with your fingers. If the groove isn't wide enough, the sleeve isn't fully installed, so retry this step.

14 REINSTALL HARDWARE

Refit the mounting hardware (if removed). Now to reinstall the shock in the frame. While taking up the weight of the rear wheel with one hand, thread the shock bolts through the frame and shock eyelets and tighten them (clockwise) to the frame manufacturer's torque specifications, using the correct Allen key(s).

15 REINFLATE SHOCK

Attach a shock pump and reinflate the shock until the desired sag is achieved – you may need to reduce/increase the pressure relative to the previous values to get the correct amount of sag. Remove the pump and reinstall the air valve dust cap. Go for a ride and use the sag indicator ring on the shock shaft to determine whether or not you've used full travel.

ROAD / OFF-ROAD

BEGINNER — EXPERIENCED — EXPERT

1-2hrs

£20-£900 for parts

INSTALLING A HANDLEBAR AND STEM

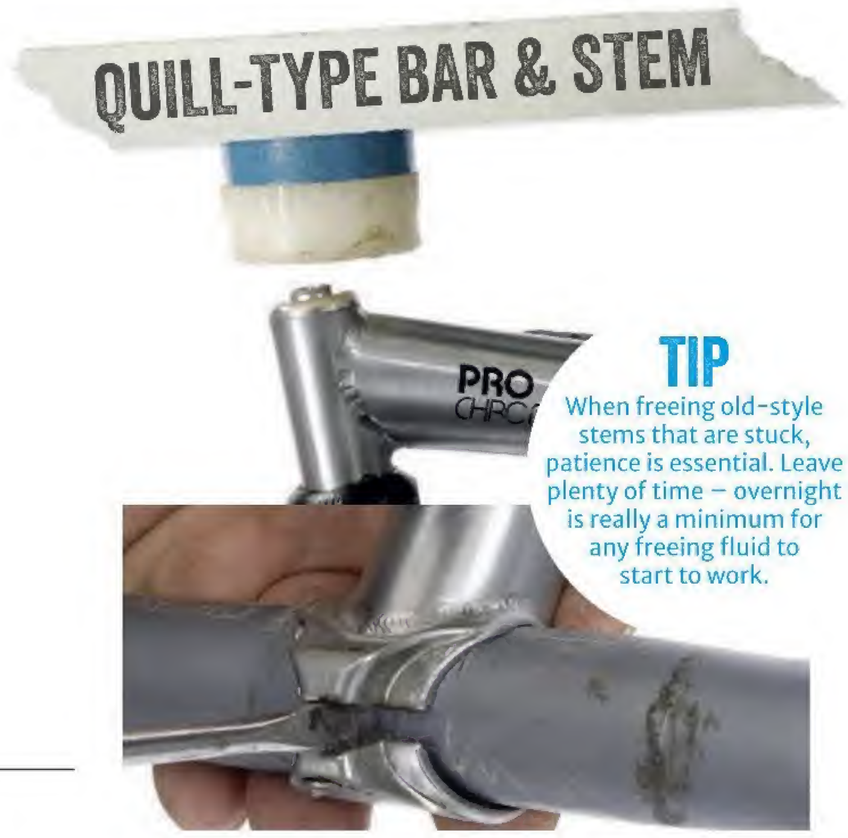
We show you how to assemble and look after your bar and stem

There are two main types of handlebar stems: threadless (also known as Aheadset) and expander bolt with quill, which is a much older style. Threadless stems clamp around the fork's steerer which, as the name suggests, isn't threaded. The stem effectively becomes part of the headset system, which is adjusted by tightening the Allen bolt in the top cap. Bar height is adjusted by installing spacers either below or above the stem. Most bikes use the threadless-type stem and headset.

The older-style stem, with expander bolt and quill, slides into the steerer and is fastened in place by an Allen bolt that pulls on either a wedge or expander, jamming the stem in place inside the steerer. It doesn't affect the headset at all, which is adjusted entirely separately.

Expander bolt stems can't be used in the steerers of forks designed for threadless headsets. With old-style screwed steerers, adaptors can be fitted to use threadless stems.

Forward-opening stems arrived with threadless stems. Combined with the threadless system, they make changing a stem much easier, because it's no longer necessary to remove a brake lever or disturb the bar tape.



TIP

When freeing old-style stems that are stuck, patience is essential. Leave plenty of time – overnight is really a minimum for any freeing fluid to start to work.

1 REMOVE BAR AND STEM

Remove the bar tape; in most cases it unwraps from the centre. Remove the STI levers or Ergopower levers as described in steps 8 and 9. Undo the expander bolt a couple of turns and, if necessary, tap it down with a soft-faced hammer to free the expander/wedge, then pull the bars and stem free. Remove the handlebar clamp bolt. Insert a screwdriver blade into the slot and turn it sideways so that the stem clamp opens a little. Now carefully slide the bars sideways. Keeping the screwdriver blade in the slot, remove the stem from the bars.

5 FITTING NEW BAR/STEM

Check the inside of the stem's bar clamping area for sharp edges. Use a medium grade (about 400) emery paper to smooth the inside of the clamp. Repeat for the clamp area that fastens to the fork's steerer. This is especially important if you're using either ultra-light aluminium or carbon fibre bars or forks with a carbon fibre or aluminium steerer. With forward-opening stems, unscrew the two, three or four bolts holding the front of the stem in place. Fit the bar and refit the front. Tighten the fastening bolts diagonally gently. Don't tighten each bolt fully down before tightening the next one.

6 INSTALLING BARS AND STEM/ADJUSTING HEADSET

Threadless stems and headsets do vary a little in depth, so it might be necessary to alter the number of spacers fitted. The stem's top or top spacer should be 3-4mm proud of the steerer after the stem and spacers are fitted. Fit the spacers and stem/bars in the desired order on the steerer so the handlebars are at the height you require. Refit the top cap and 6mm headset adjusting the Allen bolt. Tighten the top cap bolt until all play is removed from the headset while ensuring that the forks still rotate freely.

7 FINAL ADJUSTMENTS

Loosen the handlebar clamp bolts and adjust the bar so that their lower section is at a slight upwards angle. Fully tighten the clamp bolts, ideally using a torque wrench (15Nm is normally about right for an M6 bolt, 10Nm for an M5). If you don't have a torque wrench, use a standard Allen key to tighten the bolts without any excessive force. Be especially careful when using carbon fibre components not to over-tighten any bolts. Align the bars with the frame and tighten the bolts, clamping the stem to the steerer using a torque wrench or Allen key.

- ✓ 4, 5, 6mm Allen keys
- ✓ Screwdriver
- ✓ Cable and side cutters
- ✓ Anti-seize grease
- ✓ Loctite, fine emery paper

WORKSHOP WISDOM

Check that your bars and stem match. Many bars are 25.4mm, 25.8mm or 26mm diameter. These sizes are interchangeable. Oversize bars at 31.7mm or 31.8mm (also interchangeable) are now common.

Forks with threadless carbon fibre steerers can't be used with all types of handlebar stem. Those that clamp around the whole circumference of the steerer are ideal, but those that clamp the steerer with a narrow wedge may damage it with serious risks of frame damage.

As with all carbon fibre components, take care not to scratch the surfaces. Carbon fibre bars need careful fitting; check the manufacturer's instructions for advice and in all cases check the stem clamp area for sharp edges and remove them with fine emery paper if necessary. Don't clamp aerobars to carbon fibre bars.

2 QUILL STEM MAINTENANCE

Regular application of anti-seize grease is essential with old expander bolt stems. Clean and smear the quill (the upright part) of conventional stems with anti-seize grease at least once a year. Remove all stem bolts (expander, threadless and bar fixing) and smear the threads with anti-seize grease. Avoid over-tightening bars that tend to slip. Instead, apply a thin layer of Loctite to the bar's centre section and stem clamping area and then fully reassemble.

3 FITTING NEW BARS/STEM

Check the inside of the stem's bar clamping area for sharp edges and use a medium grade (about 400) emery paper to smooth the inside of the clamp. Spread the stem slot as you did when removing the bars (step 1). Slide the stem without its pinch bolt over the handlebars, turning it as you go to take it easily around the tight bends. Slide into position and replace the clamp bolt. Smear anti-seize grease over the stem's quill and lower it into the fork column. Adjust the stem until it is parallel with the bike and tighten the expander bolt. Adjust the bars to the correct angle and tighten the fixing bolt.

THREADLESS-TYPE STEMS

4 REMOVE BAR AND STEM

Remove the bar tape and STI levers or Ergopower levers as described in steps 8 and 9. With threadless (Aheadset) stems, use a 6mm Allen key to remove the top adjusting bolt complete with expander or, if a star nut is fitted, remove the bolt and top cap completely. Remove any spacing washers that are fitted and with a 6mm Allen key, loosen the stem fixing bolts a turn and pull the bars and stem free from the forks. Most threadless-style stems are forward opening with two bolts. Undo the two, three or four stem clamp bolts and remove the bars.

LEVERS

TIP

When swapping bars with STI or Ergopower levers it's often unnecessary to remove or detach the cables.

TIP

When it comes to fitting cables, make sure that you use the correct type of outer cables with longitudinal wires for the gears, and outer cabling with spiral construction for the brakes. Remember that your old outer cables might be too short if wider bars, a longer stem or higher stem position is used.

8 REMOVING AND FITTING STI LEVERS

Fit new inner brake cables before refitting STI levers to the bars. Check the length of the outer brake cables needed and cut with sharp side cutters. Mount in the desired position and gently tighten the fastening bolts. Sit on the saddle and double check the position of the levers and bar angle and adjust if necessary. Check that the levers are level and then check that they are in line with the frame. Tighten their fastening bolts. Find the best route for the brake outer cable and tape into place. Fit the inner and outer gear cables.

9 REMOVING AND FITTING ERGOPOWER LEVERS

Fit both gear and brake inner cables to the Ergopower levers before fitting them to the bars, and gently tighten the fastening bolts. Work out the length of the outer gear and brake cables needed and cut accordingly. Find the best route around the bars. Sit on the saddle and double check the position of the levers and bars and adjust if necessary. Check that the levers are level and then make sure that they are in line with the frame. Tighten their fastening bolts fully. Tape the outer cables in place.

10 BAR TAPE AND PLUGS

Tuck a little of the bar end tape into the bar ends and start the bar tape off in a clockwise direction on the right side, and anti-clockwise on the left. Holding the tape taut, overlap each turn a few millimetres. Go around the inside bar side of the levers and continue across the tops being a little more generous with the overlaps. Cut off any excess and use some insulation tape (available in plenty of colours) to securely fasten the ends. Fit the bar end plugs and make sure they are secure.

ROAD

OFF-ROAD

BEGINNER EXPERIENCED EXPERT

30 mins

£7 to £20 for new tape

REPLACING HANDLEBAR TAPE

With the new season comes the desire to spruce up your beloved bike. Our expert mechanics reveals some simple steps for freshening up your bars

Retaping your bars is one of the easier and more rewarding jobs you can do to prepare your bike for the next road season. Dark colours wear longer, but as you're staring down at your handlebars all day it might be nice to try a bright, vivid hue. You never know, it could make you go faster!

But before you get started, consider buying a new set of bars. Always play it safe: replace them after a maximum of five years of 'normal' use, or every three years or less under heavy racing and training use. If you're sticking with retaping your bars for now, here are our tips. Ask a bike shop professional to tackle any steps that are beyond your abilities.

1 PREP AND INSPECT

Begin by removing all the old tape and any padding, then check your bars for scratches, nicks or other damage. In particular, look out for deep cuts or grooves, especially under clamp areas for computers, lights, stem clamps and brake/shifter clamps; it's a good idea to remove these and have a look underneath in ample light. Replace the bars if necessary. Now reapply a light coating of grease to alloy bar/alloy clamp combos to prevent creaking, or assembly paste to any carbon bar or stem combination. Clean the bars with a suitable product (WD-40 on carbon and alloy, or white spirit on alloy bars) followed by soap and water, but nothing caustic. The old adhesive will come away with a rough cloth and a little insistence.

5 LOOPING THE LOOP

Looping around the brake levers can be another tricky job, since you'll be trying to create a tidy transition from the bottom of the bar, around the hood and upwards while maintaining an even overlap of about a third of the width. The shape and position of the brake lever hood and clamp will determine the method required. Both Shimano and SRAM have about the same clamp location, and have a small gap between the bar and the bottom end of the resin body. This allows the tape to be slipped sideways into the gap, meaning the clamp can be concealed with a horizontal strip placed across it. Ensure the looped tape doesn't cover any of the locator tab holes. If it does, reposition or snip the tape as necessary.

6 CAMPAG HOODS

Campagnolo levers require a slightly different technique. The resin body occupies more space on the bar and comes into direct contact with it all the way around, so the tape can't be tucked between the lower edge of the body and bar. This creates a larger gap that needs to be concealed if you want a tidy appearance. Cut two strips about two inches long and place them vertically on either side of the metal clamp, lined up against the resin body. These will help conceal the clamp in those areas left exposed when criss-crossing the Ergo body. Once you've finished wrapping, ensure the tape doesn't interfere with the hood anchor tabs, which need to nestle in their respective slots. Use a sharp blade to trim a notch in the tape if required.

7 FINISHING SCHOOL

Once you're satisfied with the spacing of your turns and the overall look of the tape job you can proceed with finishing the wrap in one of two ways: either with a bump (less elegant) or without. For the former option simply wrap the tape so that it ends square, then finish and hold in place with a few loops of black electrical tape, leaving a little lump. Otherwise, continue taping the bar diagonally over the centre bulge a bit. Hold the final stretch suspended over the transition line and use scissors for an angled cut across the tape but in line with the bar bulge or sleeve edge. Finish with a narrow strip of electrical tape wrapped three or four times around the bar, cut diagonally. The finishing tape strips provided never work, so don't use them.

- ✓ Electrical tape
- ✓ Blade, scissors
- ✓ Screwdriver
- ✓ Multi-tool

2 SORT OUT CABLES

While you're at it, inspect your gear and brake cable housing for cracks, kinks and corrosion. SIS outers will often fracture near the entry to the frame barrel adjusters, while the nylon covering will wear away through chafing, allowing moisture into the cables. It's a good time to put this right, as well as adjusting and trimming the lengths in order to get the best and smoothest cable run possible. You can use the Shimano shrouds pictured above to tidy things up (these were included with aero brake lever kits, but well established bike shops should have some squirrelled away that they can sell you). When you've settled on the correct position, tape up the outers tightly against the bars: this will prevent squirming under load.

3 FILLING GROOVY

Fill in any empty grooves with suitable material, in this case a stretch of Teflon lining tucked into the slot. Another option is to trim a suitable strip or two of used handlebar tape, secured into place with electrical tape. Or simply to fit a piece of brake or SIS outer to keep the shape of the bar round. If you're looking for more comfort or experience sore palms, different types of padding are available and can be added as desired. Specialized's Body Geometry Bar Phat gel inserts are excellent, while Marsas makes a lightweight type of foam. Or there's Bontrager's Gel Cork tape with integral gel padding, which is also excellent and is a lot simpler to install as there are no separate strips to fit into place.

4 BEGIN TAPING

Some tape brands print their logos evenly spaced and designed to show at every turn; if you start winding with the logos visible you might get them to line up along the top of the bar with a little practice. You can start the wrap by simply overlapping the first winding once, then proceeding diagonally upwards, overlapping by about a third of the tape width. This will leave a small bump at the start of the bar. If you prefer a smooth, flat appearance then start winding with the tape already positioned diagonally. Once the entire stretch has been completely wrapped, carefully trim the overhanging edge with a sharp blade, using the edge of the bar as a guide. This will give you a smooth, flat start.

8 PICK AND CHOOSE

Cotton tape feels good and gives that perfect retro look. Still popular on the velodrome and brilliant for fashionable fixies, the coarse weave texture and lack of padding give an unmatched grip while enhancing the direct feel and sense of control over the bike. When it gets faded you can simply double it up by adding a second layer. Work from the bottom up, which will create an overlap pattern that prevents the tape curling away at the top bend due to prolonged palm pressure. For a different look, why not stretch some leather across your bars? The warm, natural feel has just the right amount of grip, gets better with age and adds an extra touch of class to any bike. Install at room temperature in clean conditions.

9 EXTRA CREDIT

Improve your grip or add a splash of colour by replacing your hoods. When the rubber gets old and perished, these can drift from their correct positions and interfere with your shifting. Campag hoods are more prone to this, as their rubber formula is a little gummier and seems more susceptible to caustic hand sweat and pressure, causing them to soften and distort over time. Use some slightly soapy warm water as a lube and pry the hoods off with a bamboo chopstick, tyre lever or ball-ended Allen key, as above. Place the new hoods in warm water to make them more malleable and minimise the risk of tearing. Roll the rubber back halfway, loop over the brake levers and pry over the Ergo bump; stretch out, then insert locator tabs.

10 PLUG AND PLAY

Finish off with a really good set of handlebar plugs. Play it safe and make sure you never go riding without them. The traditional threaded expander models, such as the Specialized ones pictured above, are excellent. When screwed in firmly they don't fall out again easily, and if you do hit the deck they shouldn't get yanked out on the first bounce, so you won't be impaled on the second. These are particularly useful on track bikes. If the plugs provided in your tape packaging are too loose for your bar diameter, just bulk them up with a few wraps of electrical tape until they're wedged in tightly. Or, proceeding straight on from step four, simply tuck in and plug the tape surplus rather than trimming it. Job done!

OFF-ROAD

BEGINNER

30 mins

Free

COCKPIT CONTROL

Our step-by-step guide shows you how to set up your handlebar and bike controls for optimum operation and personal comfort

1 TRIMMING THE BAR

If you're particularly narrow shouldered you might find some modern riser bars a fraction wide, but before you cut anything slide the grips and the controls inboard 5mm from both ends then ride and see if the new position feels more comfortable. If it does then trim the ends with a sharp hacksaw or pipe-cutter. If you have a carbon bar wrap the cutting area in masking tape before cutting to reduce the risk of delamination and fraying.

TIP

Pay attention to the condition of the steel bolts used to secure stems and other bar controls. They can dry out and corrode, making them far more likely to damage their alloy threads. Give a dab of grease to prevent this.

TIP

While you're adjusting your grips, stick a few different sized zip ties inside your handlebar. You never know when you might need to tie something back together as an emergency get-you-home measure.

5 STEM FACEPLATE

Doing up the stem faceplate bolts evenly and accurately is essential for a well set up and safe cockpit. We wince when we see stem faceplates with the top two bolts done up so tight the top edge of the faceplate touches the top edge of the stem, leaving the lower two bolts barely engaged in thread. This poorly distributes the stem's clamping force and can lead to the bar slipping or being damaged, or even breaking completely.

6 BOLT BALANCE

Bolts on one side of the stem can loosen as you do up those on the other side. Counter this by using cross sequential tightening. Tighten all bolts to finger tight, then – looking at the cap head on – tighten the top right bolt by two turns, then the bottom left two turns, then the top left two turns, lastly the bottom right two turns. Follow this pattern keeping the gap between faceplate and the stem extension evenly spaced, both left and right, top and bottom.

7 GETTING A GRIP

We recommend lock-on grips for their all-weather grip on the bar. Go for a set that suit your hand size, and err on the side of softer rubber for comfort. Many brands make bolt-on grips with only one inboard bolt per grip, which feel especially nice if you ride without gloves or with thin gloves.

11 ANGLE OF DANGLE

You can easily adjust the angle of the brake levers by loosening the Allen bolts and twisting the clamp around the bar. Adjust them so that the lever more or less falls in line with the angle of your arms from your torso as you sit on the bike in your normal riding position, to prevent strain on your wrists. Riders doing lots of descending may want to position the levers higher, nearer to the horizontal, to counter being further back off the saddle.

12 GEAR POSITION

With the brake lever position determined and recorded, move the gear shifters to a position on the bar where you can easily access the triggers without them fouling the brake levers while seated on the saddle – fouling happens more often when using different brand brake and gear levers. Check by pushing the triggers through their complete arc of movement. Beware if using grips with a throttle flange as these can catch gear shifters.

13 GETTA GRIPSHIFT

The popularity of Gripshift may have waned, but it's still a great gear changing system. If you butt the brake lever perch up to the plastic housing of the shifter, make sure it does not foul the action of the lever (Hope Minis do this). Correct this by spacing them a few millimetres apart. Also ensure the shifter is clamped to the bar (using the 3mm grub screw) and that the shifter is orientated so the full range of gears are attainable in a single sweep.

- ✓ Tape measure
- ✓ Allen keys
- ✓ Grease
- ✓ Hacksaw
- ✓ Masking tape

WORKSHOP WISDOM

It takes time to learn to use a torque wrench after years of guessing how tight is tight enough, but it's a good habit to nurture. Buy a cheap one and keep it with you.

2 BAR ROTATION

Bars are made with an amount of rearward sweep (backsweep) and most risers have some upsweep too. Rotating the bar in the stem clamp changes the position of the controls surface, giving more or less backsweep and upsweep. How you set up the bar depends on personal taste and riding style, but most riders opt for a position where the rise section (between the bends) is near vertical. This gives a neutral position on the bar for the controls.

3 STEM ANGLE

Getting the stem in line with the front wheel sounds simple, but can be tricky. Loosen the stem's steerer clamp bolts and give the bar a wiggle to free up the stem. Don't let it be so loose that it swings about or it'll be hard to keep the stem in the correct position while you tighten the steerer bolts. With the front wheel held firmly between your knees make fine adjustments until straight. It can take a few minutes and some squinting to get it dialled.

4 STEM BOLT TORQUE

Tempting as it is to get out that set of long handled T bar ball-ended Allen keys your gran gave you for Christmas and start winding on torque until the head of the bolt rounds off or the alloy thread you're screwing into strips, you shouldn't for those very two reasons. Most stem bolts only require torquing to 3-6Nm. We recommend using a torque wrench, but if you don't have one, that's about the same force you'd use to open a door handle.

8 BAR ENDS

Using bar ends is one of the quickest ways (along with clipless pedals) to turbo charge your XC riding. They allow use of your bigger bicep muscles instead of the weaker triceps that climbing on the bar alone uses. Exact bar end positioning is down to personal preference though somewhere between about 30 degrees upward from horizontal and a few degrees below horizontal seems to work for day riders and racing snakes alike.

TIP

Use a tape measure to make sure everything is properly centred and spaced. A few millimetres might not seem like much in the workshop, but it can translate into an annoying distraction on a long climb or in a race.

9 BRAKE POSITION

It's normal for bikes to come from the factory or dealer with all the controls slammed up against the inboard edge of the grip. This looks tidy but reduces your ability to use the controls to their full potential. It forces you to squeeze the brake lever nearer to its pivot, which isn't efficient. Move your brake levers inboard so that your braking fingers are using the last 3cm of the lever. This gives you maximum leverage and greater bite control.

10 BRAKE REACH

It's vital you can comfortably reach the levers with your braking fingers. Most brakes come fitted with their lever blades set with their reach adjustment wound fully out, meaning small hands will struggle to reach. Most models have a grub screw (usually a 2 or 2.5mm Allen head) near the lever pivot. This can be wound in or out to adjust the resting position of the lever blade. Spend some time getting it dialled; you'll reap the benefits every ride.

14 DEBURR

If you're fitting a new handlebar or stem, check the stem's clamp areas (on both bar and stem) to ensure there are no sharp edges, machining burrs or non-radiused (unbevelled) edges. Such burrs and edges can cause microscopic damage to the bar (especially carbon bars), which can slowly grow into cracks. Often the first you'd know about it is when the bar snaps mid-ride. Remove such maladies carefully with fine emery paper.

15 REMOTE CONTROL

Many suspension forks have remote lock-out or damping adjuster levers attached to handlebar bracket mounts. Ensure the lever is attached securely to the bar and that it does not impede your use of brake/gear levers or get in the way when using other hand positions on the exposed bar that you might use when cruising flats or climbing steep hills. RockShox remotes can be changed for a leg top adjuster if you don't like clutter on your bar.

16 CARBON PASTE

Carbon fibre is a very strong material but it can also be fragile if treated in the wrong way. You can go a long way to protecting your carbon handlebar by using a smear of carbon fitting paste. This acts like a grease but its microscopic make-up of millions of tiny synthetic balls helps reduce slippage in the stem clamp without the need to apply unnecessary torque, so reducing the chances of crush damage or cracks from stem clamp edges.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

1 hr 30 mins

£200 for Angleset

HOW TO FIT A CANE CREEK ANGLESET

Altering your bike's head angle with an angled headset can totally transform the ride

1 REMOVE BARS AND FORK

Clean your bike and clamp it in a workstand. Remove the front wheel and front brake calliper. Place the brake assembly (calliper and hose) out of the way. Remove the stem top cap and loosen the steerer clamp bolts. Remove the stem from the steerer and the fork from the head tube. A light tap with a rubber mallet may be needed to get it moving.

5 EXAMINE FRAME

To align the offset cup correctly, you'll need to draw some marks on your frame. If it's welded along the centre of the top or down tube, this makes things easier – you have a vague centre line to work with. If you're installing the offset cup in the top of the head tube, you'll need to mark the top tube. If you're fitting it in the bottom, you'll need to mark the down tube.

6 MARK THE FRAME

Using a Vernier calliper, measure the width of the top or down tube about 20cm back from the head tube. With the Vernier closed on the frame, make a mark at the centre point. Repeat this at around 10cm and 5cm back from the head tube. This should give you three marks to work from.

7 CHECK MARKS AGAIN

Using a metal ruler, align the three marks. Continue this line forward and mark the corresponding points on the front and rear of the inside of the head tube. These marks should be at the exact centre, giving you somewhere to aim for when installing the cups. It can help to mark the outer faces of the head tube too. Make sure you complete this step accurately.

11 REMOVE CROWN RACE

Using a crown race remover, remove the old crown race from your fork. Grease the area where the new crown race will sit, then install it using a crown race setting tool. While you have the fork in your hand, check the star nut is installed correctly – it should be central in the steerer tube and about 15mm from the top. If it isn't, you'll need to install a new one.

12 FIT ANGLESET LOWERS

Greasing everything as you go, sit the lower bearing on the crown race and the lower gimbal on the lower bearing. Grease the area in both of the cups where the gimbals will sit. Now assemble the upper gimbal, bearing, compression ring and dust cover on a workbench or other clean surface, remembering to grease everything.

13 FIT ANGLESET UPPERS

Slide the fork steerer up through the head tube, making sure the bottom gimbal doesn't touch the lower cup yet. Then slide the upper gimbal, bearing, compression ring and dust cover over the top of the steerer, again ensuring they don't touch the cup. Now move both gimbals into position simultaneously so they land in the corresponding cups at the same time.

- ✓ Rag
- ✓ Vernier calliper
- ✓ Allen key set
- ✓ Headset reamer/facer
- ✓ Headset press
- ✓ Headset cup remover
- ✓ Rubber mallet
- ✓ Metal ruler
- ✓ High quality thick grease
- ✓ Thin felt marker pen
- ✓ Crown race remover
- ✓ Crown race setter

WORKSHOP WISDOM

There are some important steps to fitting an Angleset that make it more complicated than fitting a normal headset. Using a workstand is a must, not an option. Making sure the star nut is sat bang in the centre of the steerer tube is vital too – without equal force on the bearings, your headset will creak and feel odd. When fitting the gimbals, make sure everything is in line before applying any pressure, and do so simultaneously at both ends of the head tube. This will ensure that everything tightens down in perfect alignment. If you're not 100 per cent confident, don't attempt this procedure – your local bike shop will be happy to help out.

2 REMOVE OLD HEADSET

Remove any loose parts from the old headset and put them aside. Using a headset cup remover and a hammer, remove the old headset cups and put them aside. It's important now to give the inside and end faces of the head tube a clean. You also need to make sure that the head tube has been faced – the end faces should just be smooth bare metal.

3 CHECK HEAD TUBE

IIf there's paint on the end faces or the surfaces aren't flat and even, you'll need to get the head tube faced. If the inside press-fit faces have any scoring or damage, you'll need to get the head tube reamed. If in doubt, get the head tube checked by your local bike shop. Once the frame is ready, it's time to unpack your new Angleset.unpack your new Angleset.

4 CHECK ANGLESET CUPS

First, determine which offset cup you need to to use to achieve your desired head angle. Then consult the manual that comes with your Angleset to check whether the offset cup should be pressed into the top or bottom of the head tube – this will depend on your frame. Here, we're installing a zero-offset cup in the top and a -1.5-degree offset cup in the bottom.

8 PRESS ZERO-OFFSET CUP

The zero-offset cup needs to be pressed in first. Coat the inner face of the corresponding end of the head tube with grease (in this case, the top end). Then use a headset press to insert the cup. Because there's no offset to worry about, you don't need to align the marks on the cup.

9 CHECK ORIENTATION

Now to press in the offset cup. Again, coat the inner face of the corresponding end of the head tube with grease (in this case, the bottom), but this time make sure you can still see your marks from earlier. Sit the cup in the frame. To achieve a slacker head angle, the offset bore should face the back of the bike. To go for a steeper fork angle, the offset should face forwards.

10 PRESS OFF-SET CUP

Align the notches in the cup with the marks on the frame, making sure that the cup is orientated correctly to achieve the steeper or slacker head angle you're after. Once aligned, push the cup into the head tube by hand so it sits in the right place. Then use a headset press to press it into the frame.

14 REFIT COCKPIT

Keep everything held together while you replace any spacers on the steerer tube and refit the stem. Replace the stem top cap and bolt. Tighten the bolt until the whole system is snug – this will feel tighter than usual because the gimbals need to be seated in place. Once the system is tensioned, turn the handlebar lightly to make sure the bearings aren't over-tight.

15 REFIT FORK AND BRAKE

Refit the front brake and wheel. Align the calliper by loosening the two fitting bolts and then retightening them while holding the brake on. Make sure the stem is lined up with the front wheel and tighten the steerer clamp bolts to their recommended torque. Go for a short, car park type ride. If the headset hasn't settled in properly during installation, this will ensure it does.

16 CHECK FOR PLAY

Hold the front brake on and feel for play in the headset – there will probably be some. Loosen the stem's steerer clamp bolts and tighten the top cap bolt until all play in the system is removed. Torque the steerer clamp bolts up again and you're ready to get riding!

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

30 mins

£None

ADJUSTING YOUR CONTACT POINTS

A few simple adjustments can make your bike more comfortable, efficient and confidence-inspiring, transforming your riding.

1A CHECK THE ANGLE

If the nose of your saddle is angled too far you'll waste energy constantly trying to correct your body position. It should be sat roughly horizontal, though if you spend a lot of time climbing, tipping the nose down slightly can improve comfort and your position on the bike. If you need to change the angle, first note where the saddle rails are clamped by the seatpost.

2B THE RIGHT ANGLE

Rolling the bar can make a big difference to how your cockpit feels and dramatically affect your riding position. Use an Allen key to loosen the stem's bar clamp bolts, turning them just enough so you can rotate the bar (if you have a carbon bar, undo the bolts fully). Sit on the saddle and roll the bar forwards and backwards to find the best position. Tighten the bolts to the specified torque.

4B REMOVE THE TOP CAP

Insert a 5mm Allen key into the stem's top cap bolt and turn it anticlockwise to loosen and remove the bolt and top cap. Then use a 4 or 5mm Allen key to loosen both of the stem's steerer clamp bolts, again turning them anticlockwise. Remove any spacers above the stem, slip the stem off the steerer and then remove any spacers below the stem – leaving the top cup of the headset well alone.

4C ADJUST THE SPACERS

The more spacers you place under the stem, the higher your bar will sit. Likewise, the more spacers you remove from below the stem and place on top of it, the lower your bar will sit. Reinstall the stem and spacers in the configuration you'd like to try, making sure there are the same total number of spacers on the steerer tube as before.

4D REFIT BARS AND STEM

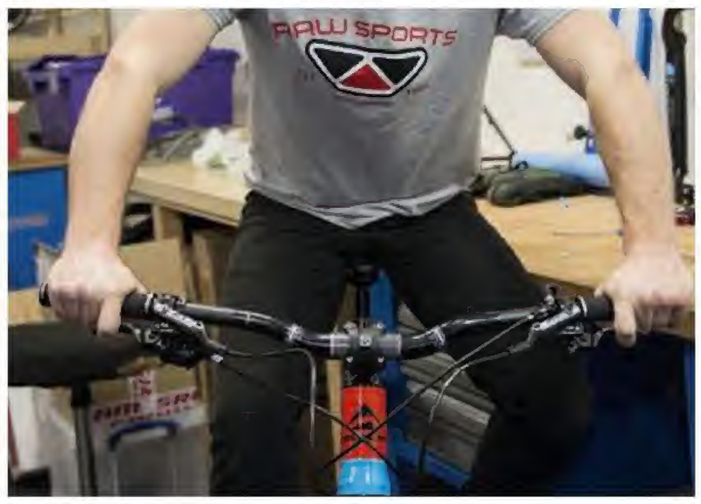
Pop the stem's top cap and top cap bolt back in place. Turn the bolt clockwise – it's there to tension the headset bearings so only needs to be tight enough to remove play in the headset. To check for play, hold the upper headset assembly and rock the bike back and forth. Straighten the stem so it's in line with the front wheel and tighten the bolts to the specified torque.

- ✓ Spirit level
- ✓ Allen key set
- ✓ Torx key set
- ✓ Grease
- ✓ Torque wrench and bits

WORKSHOP WISDOM

Adjusting your bike's contact points can make a huge difference to your ride, and it's worth experimenting to see how different set-ups can feel and which suits you best. You can go further than we have here by fitting a bar with a different rise or sweep, a longer or shorter stem, swapping out saddles, and so on. But you should be able to achieve a pretty good set-up that'll improve comfort and control without spending a single penny.

As so much of this comes down to personal preference, take your time when making adjustments, only altering one thing at a time and taking note of the effect. If you're after some specific advice or need some help, go and chat to an expert in your local bike shop.



1B SINGLE-BOLT CLAMP

If your seatpost has a single-bolt saddle clamp, use the appropriately sized Allen or Torx key to turn the bolt anticlockwise until it's loose enough that you can adjust the saddle angle. Tilt the saddle to your required angle, being careful to maintain the same clamp position on the saddle rails. Retighten the bolt to the manufacturer's specified torque setting.

1C TWIN-BOLT CAMP

If your seatpost has a twin-bolt saddle clamp, loosen both bolts until you can move the saddle. Tilt it to your required angle, being careful to maintain the same clamp position on the saddle rails. Tighten the front bolt by turning it clockwise, stopping before the saddle angle starts to alter. Then tighten the rear bolt, ensuring the saddle remains in the correct position.

2A THE RIGHT WIDTH

Bar width comes down to personal preference, but too narrow and your high-speed control will be compromised, and too wide and you'll feel stretched out and uncomfortable. If you have lock-on grips, you can experiment by moving them inwards to see how a narrower bar would feel. If you decide to cut the bar down, remember to 'measure twice, cut once'.

3A ADJUST THE POST

Saddle height is very important – even 1-2mm can make a big difference to your pedalling efficiency and comfort. Loosen the seat collar by turning the Allen bolt anticlockwise or flipping out the quick-release lever and turning it anticlockwise. Adjust your saddle to roughly the right height, then tighten the bolt/QR. If you have a dropper post, check it's fully extended.

3B CHECK KNEE ANGLE

Sit on the saddle and rotate the cranks so one foot is in the 12 o'clock position and one at 6 o'clock. With your saddle at the correct height, you should be able to rest your heel on the lower pedal with your leg almost straight. This means when you clip in – or on flat pedals, when the ball of your foot is over the pedal axle – your knee should be slightly bent.

4A BEST BAR HEIGHT

A higher bar helps create a more relaxed, sat-up position on the bike. This is great for steep downhill trails because it pushes your body weight further back on the bike, but it can leave you fighting for front wheel grip on flatter tracks and climbs. Getting bar height right takes time so it's worth trying a variety of positions. You can get bars with different rises, but for starters try experimenting with the spacers.

5A ADJUST YOUR CONTROLS

Once you're happy with your bar position and height, it's time to adjust your brake levers and shifters. Use the appropriate Allen or Torx key to loosen all the clamp bolts so the levers and shifters can be moved easily along the bar. Sit on the saddle and hold the bar as if you were riding, leaning against a wall so you don't topple over. Stretch out your index fingers.

5B THE BEST POSITION

Move each lever so the crook at the end of the lever blade is under your index finger, then cinch up the clamp bolts. Now do the same with the shifters, ensuring they're easy to reach but don't get in the way. Once everything is in place, check all the bar clamp bolts are tightened to the manufacturer's specified torque settings.

5C GET THE RIGHT REACH

Most brakes offer tool-free lever reach adjustment, and some have bite point adjustment too. Lever reach is the most important. You want the lever to be close enough to the bar so you can hook your index finger over it, but not so close that it touches your other fingers when you brake. Turn the dial to adjust the reach. If there's no dial, use a 2 or 2.5mm Allen key.

ROAD
OFF-ROAD

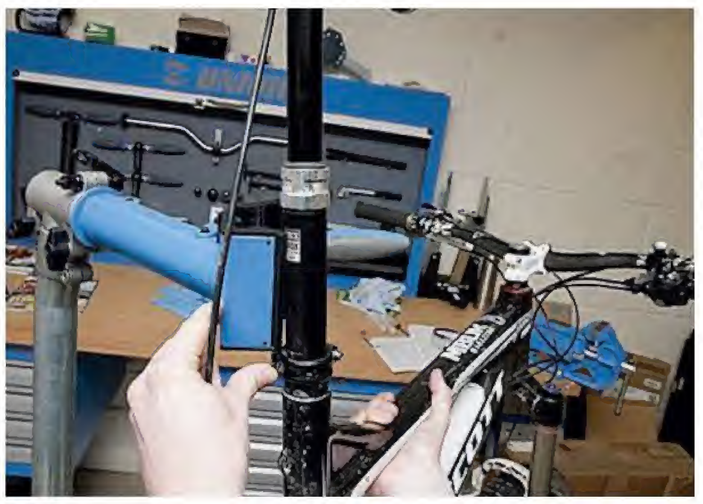
BEGINNER EXPERIENCED EXPERT

30 mins

Bleed kit £40, RockShox suspension oil 2.5wt £4

SERVICE A REVERB DROPPER POST

Want to get that tired RockShox Reverb dropping smoothly every time? We show you how to keep it in tiptop condition with a DIY service



1 GET SET UP

Undo your seat clamp, raise the whole seatpost up to the minimum insertion mark, then reclamp. Place the bike into the stand and clamp at the lower section of the post without getting the hose caught. Adjust the bike in the stand so the remote lever sits higher than the saddle. If you're not using a stand, the remote lever still has to be higher than the tip of the saddle.

5 PREPARE THE SYRINGES

Screw the brass syringe fittings tightly to both syringes. Fill the first syringe three-quarters full with RockShox 2.5wt suspension oil. Turn the syringe so the brass fitting is facing upward and hold a rag over the end. Gently depress the plunger to remove any air from the syringe, catching any oil in the rag. This will be the remote lever syringe.

6 THREAD THE LEVER SYRINGE

Using a T10 Torx key, gently turn the remote lever bleed port screw anti-clockwise to remove it and put it in the storage tray. Carefully thread the lever syringe (three-quarters full of oil) into the bleed port, turning it clockwise until it's tight. The syringe can now simply hang by its hose while you move to the post.

7 FIX UP SEATPOST SYRINGE

Fully depress the second syringe to empty all the air from it. Remove the bleed port screw on the seatpost (located on the driveside of the post up near the seat cradle) with a T10 Torx key, turning it anti-clockwise. Screw the empty, fully depressed syringe into the seatpost bleed port.

11 PURGE AGAIN

Repeat this purging procedure, pushing oil with one syringe and pulling it through the system with the other, until no more bubbles appear at either syringe. The amount of times you need to do this can vary with each service, so just keep going until there is no air left in the system.

12 REMOVE SEATPOST SYRINGE

Double-check that the rag around the seatpost is still in position. Depress the plunger of the seatpost syringe until there's only a small amount of oil left. Remove the syringe from the seatpost bleed port, turning it anti-clockwise, and replace the bleed port screw turning it clockwise until you reach 1.7Nm with the torque wrench. Clean any excess oil up.

13 REMOVE AIR FROM REMOTE SYRINGE

Hold the remote lever syringe upright. Extend the plunger to remove any air while pushing the remote button in, then depress the syringe plunger while allowing the remote button to pop back out. Repeat eight times. Now depress the syringe again, rotate the remote lever's speed barrel adjuster from anti-clockwise to clockwise and back again, four times.

- ✓ Lint-free cloth or rags
- ✓ Torque wrench
- ✓ RockShox suspension oil in 2.5wt
- ✓ T25 Torx key
- ✓ T10 Torx key
- ✓ Safety glasses
- ✓ Rubber gloves
- ✓ Reverb bleed kit
- ✓ Oil pan or bucket
- ✓ Isopropyl alcohol
- ✓ Storage tray
- ✓ Bike stand

WORKSHOP WISDOM

This tip might seem obvious, but as we almost did it when servicing our post, it's well worth noting again – don't clamp the Reverb hose in the work stand clamp. Hydraulic hoses are tough and can withstand a lot of use and some abuse, they rarely function correctly after being crushed against a seatpost and clamp! There's nothing to worry about if you're running a stealth version though.

2 FULLY EXTEND

Use the handlebar remote lever button to extend the seatpost to its full height. Again, check that the saddle is still lower than the remote lever. Dial the remote lever's speed barrel adjuster anti-clockwise (the opposite direction to the arrow) so that the return speed is set at its slowest.

3 REPOSITION THE REMOTE

Use the T25 Torx key to loosen the remote lever clamp and reposition the remote so that the bleed port bolt (the small Torx bolt near the speed adjuster) is at its highest point on the remote lever, then gently retighten the remote lever clamp bolt.

4 PROTECT AGAINST OIL

Drape a clean rag around the seatpost, positioned as close to the top as possible. Place another rag around the remote lever, and put a bucket or oil pan directly underneath it on the floor to catch any stray drips. If you're especially clumsy, remove your front wheel and disc brake pads to completely rule out the chance of any oil contamination.

8 PURGE THE SYSTEM

Hold both syringes upright to prevent any air entering the system. Gently depress the plunger on the remote lever syringe to push oil through the system and remove any air bubbles. This is known as purging. While doing this, gently extend the seatpost syringe's plunger. Keep depressing the remote lever syringe until there's only a small amount of oil left.

9 REMOVE EXCESS AIR

It's common to get a build-up of air in the seatpost syringe. If the amount of air in the syringe restricts how much oil you can pull/push through, unscrew the syringe from the bleed port and hold it facing upwards. Wrap a rag around the end of it and gently depress the plunger, forcing the air out. Reattach the syringe to the seatpost, turning it clockwise until tight.

10 PUSH OIL IN

Now push the oil back through the system by reversing the process. Gently depress the plunger on the seatpost syringe while extending the plunger on the remote lever syringe. You should notice air bubbles forming in the syringes as you remove the air from the system.

TIP

If your seatpost is still slow to respond to lever requests, the air pressure could be an issue. Remove the seatpost to access the air valve at the base of the unit and, using a shock pump, increase the air pressure to around 250psi.

14 PRESSURISE REMOTE SYSTEM

Gently extend the syringe plunger to dislodge any air from the remote. Depress the syringe plunger while turning the speed adjuster anti-clockwise all the way to the full slow position. Keep pushing on the plunger to pressurise the system while gently pushing the remote button in, then allow the system pressure to push it back up to the fully extended position.

15 REPOSITION REMOTE LEVER

Remove the syringe from the remote lever bleed port and use a T10 Torx key to screw the remote lever bleed port screw back in. Using a torque wrench, tighten it to 1.7Nm. Loosen the remote lever clamp bolt and rotate it until you reach the required position on the bar, then tighten the bolt to 5-6Nm. If you removed your wheels and brake pads, pop them back in.

TIP

If your seatpost still isn't working as smoothly as you'd like and the oil/air bleed wasn't enough, the post will require a full service. Head to www.sram.com for more tech support.

16 FINAL FIXES

Spray isopropyl alcohol over the remote lever assembly, hose and the top of the seatpost. Give it a good wipe down. Drop the bike down from the stand, undo the seat clamp and reposition the seatpost to the desired height in the frame. Operate the post with the remote lever to check it's all working properly before hitting the trails.

ROAD
OFF-ROAD

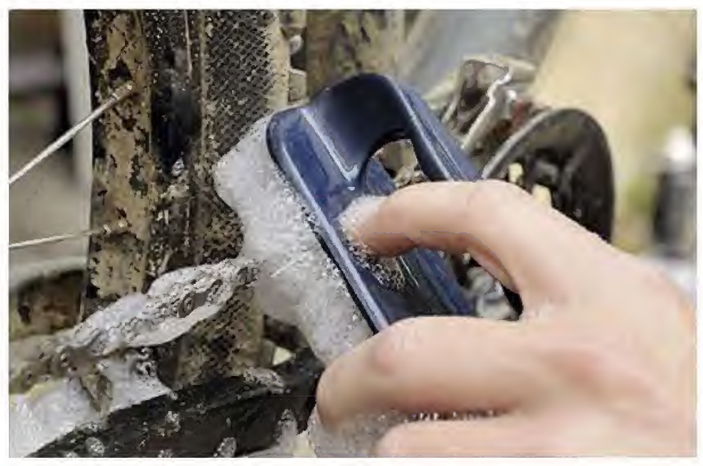
BEGINNER EXPERIENCED EXPERT

60 mins

£15 for degreaser, grease, lube

CLEANING YOUR BIKE

Want a smoother running bike in just 16 easy steps? We show you how with our straightforward walkthrough guide



1 SCRUB CHAIN

The chain is the most important part of the transmission. The first step to cleaning it is to use hot water. Wearing rubber gloves will help you use hotter, more effective, water. Add regular washing-up liquid to your bucket of water and allow it to foam up. With the chain in the biggest gear, apply the mixture vigorously using a stiff bristle scrubbing brush. You'll see a bright, shining chain emerge.

5 SCRAPE OUT REAR MECH

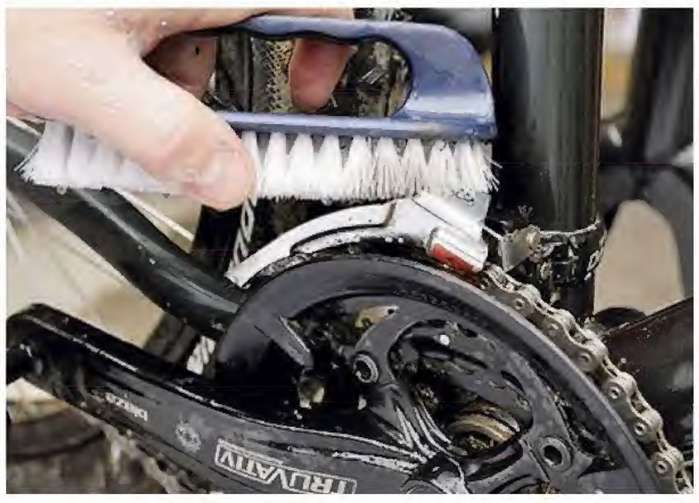
There's no point having a free-running chain if the jockey wheels of your rear mech are bunged up. Use an old spoke or the blade of a thin, flat-bladed screwdriver to carefully hook out any old grass and oily gunge that's trapped between the jockey wheels and the mech arm side plates.

6 SCRUB JOCKEY WHEELS

With the serious grime gone, use a little degreaser and an old toothbrush to scrub the jockey wheels (not forgetting the insides of the mech arm). It's possible to unscrew the jockey wheels from the mech arm, but we don't recommend you do so unless you've got a thread lock to use when reinstalling the pivot bolts. Sadly, we've seen too many rides ended by bottom jockey wheels falling out.

7 LUBE JOCKEY WHEELS

Re-lube the jockey wheels. They really only need the very lightest touch of lube, as they'll pick up enough from the chain through use. Remember these little wheels attract a lot of dirt, and with lube being sticky, it doesn't pay to make matters worse by overdoing it. Wipe the excess away with a rag. They should look dry.



11 SCRUB FRONT MECH

Front mechs always suffer from neglect. They're hard to access and are often jammed full of dry mud, and have pivots drier than a Jacob's Cracker. The first thing you can do to get your front mech swinging happily again is to apply steaming soapy water and give it a good clean. Use a small toothbrush to get right into the parallelogram and underneath the band.

12 WIPE FRONT MECH

Give the mech a good going over with the rag. Use a thin strip of rag to thread though the body of the front mech; this allows you to floss the body. Don't overlook the inside of the front mech cage, as these get pretty grubby from rubbing the chain all day. A couple of minutes and you should have a gleaming front mech.

13 LUBE FRONT MECH

Use the lube dropper bottle to apply drops of lube to all the pivots on the front mech. These take a lot of load, and can use all the help you can give them to remain mobile. Shift the mech into the smallest chainring and then work the parallelogram with your fingers to get the lube worked in.

- ✓ Bucket of very hot, soapy water
- ✓ Brushes and sponges
- ✓ Old toothbrush and spoke
- ✓ Flat-blade screwdriver
- ✓ Degreaser,
- ✓ Grease,
- ✓ Chain lube
- ✓ Polish and rags

WORKSHOP WISDOM

You can get away with just cleaning the important parts, but a full wash-down should be part of your regular post-ride plans. Take the wheels off the bike and wash everything, beginning with the underside of the saddle and working downwards.

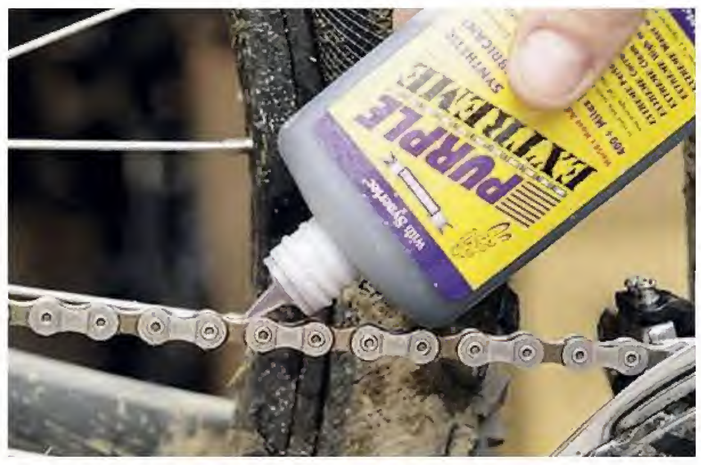
If you love your bike, show it off by taking a soft duster and some nice polish and giving the paintwork a buffing it'll never forget. Apart from making the bike look shiny, it also helps make it harder for dirt to stick to the frame the next time you're out.

2 DEGREASE CHAIN

With the chain free from dirt, apply a biodegradable degreaser to the chain and allow it to soak into all the links. This will remove any debris and sticky residues you can't see, and make for a free-running chain. Rotate the cranks backwards a few times to get the degreaser right into the links. Allow to drip-dry, or wash off with clean water.

3 WIPE CHAIN

Use a soft rag to wipe the chain completely clean, you'll be surprised what still comes off a clean-looking chain. You're trying to massage the links, moving them through as wide a range of movement as possible – this helps expose the sections of link normally hidden from view.



4 LUBRICATION

Apply lube only when the chain is clean. We prefer to lube a chain as little as possible, with as light a lube as we can get away with. Use a dripper bottle, because it's easier to apply accurately and with minimum wastage. Coat the whole chain, spinning the cranks to force the lube into the links. That's where lube is most useful, not coating the outside plates as many believe. Wipe excess lube away with a rag.

TIP

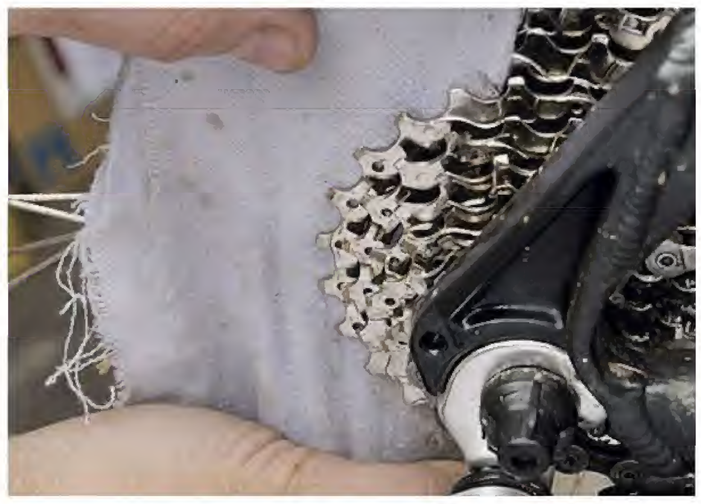
Add a drop of lube to your brake lever pivots — they dry out too and work better with some liquid love. Ditto the shifters. For SRAM X9/X0 gears, simply unscrew the top caps and drop a few drops on the spring and cable nipple. With Shimano, undo the plastic grub screw and put a few drops inside before replacing the grub screw.

8 UNCLIP CABLES

Set the rear gears into the largest rear sprocket and then, without letting the rear wheel spin, shift into the smallest rear sprocket. This will free up a bunch of inner cable and allow you to pop the outers from the slotted cable stops on the frame. With the cables now fully unclipped from the frame you can inspect, clean, re-lube and reinstall everything.

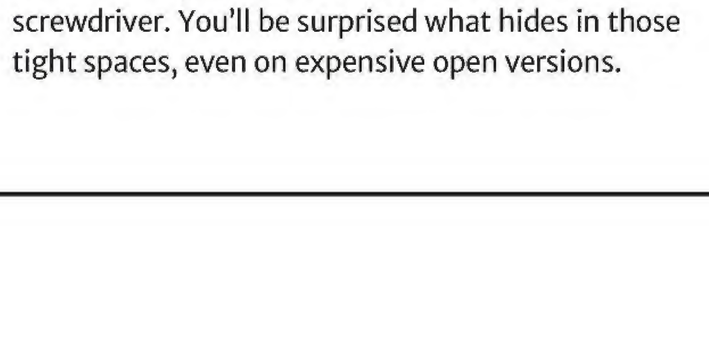
9 WIPE CABLES

Slide the outers to expose previously covered sections of inner cable. Give the entire inner cable a wipe-over with a section of rag soaked in degreaser. If you come across any sections that are rusty, replace with a new inner cable. Most dry cables can be reinvigorated with a little light grease.



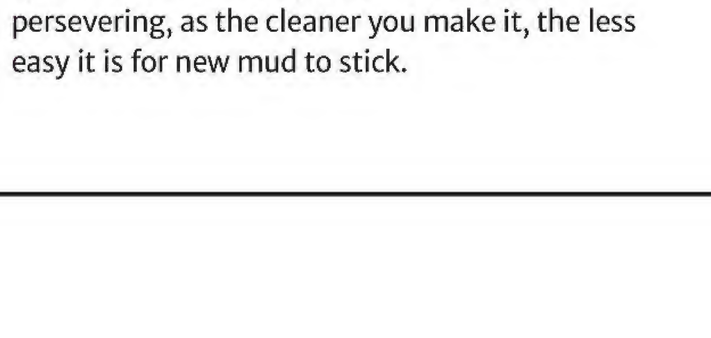
10 LUBE CABLES

The best way to apply grease evenly to a cable is to first apply the grease to a clean (lint-free) rag. Holding the rag in one hand with the greased section between thumb and forefinger, gently pinch the section of inner cable in the rag and draw it through. The idea is to allow the grease to get into the fine strands of the cable without creating any excess blobs of grease.



14 DE-GUNK REAR SPROCKETS

The rear sprockets are the final port of call on this bicycle maintenance mystery tour. They're full of technology to help faster shifts, but also full of grease, mud and grass. Pick the worst lumps out with an old spoke or the blade of a thin, flat screwdriver. You'll be surprised what hides in those tight spaces, even on expensive open versions.



15 SCRUB REAR SPROCKETS

Get the hot soapy water on them and get scrubbing with a brush. Really stubborn grot can be shifted with a dose of degreaser and another hit with the scrubbing brush. Getting to the backs of the sprockets can be tricky, but it's really worth persevering, as the cleaner you make it, the less easy it is for new mud to stick.

16 WIPE REAR SPROCKETS

Give the sprockets some flossing with your strip of rag. This helps dry the sprockets, and also buffs away any outstanding marks. The cleaner you can keep your sprockets, the faster they'll shift and the longer they'll last. Dirt acts like a grinding paste when in contact with any part of your transmission, so get rid of it.

OFF-ROAD

BEGINNER

up to 2 hrs

0-£50

SETTING UP YOUR BIKE FOR THE SUMMER

Our step-by-step guide to prepping you bike ready for summer, from checking the frame and wheels to sealing your tyres

1 SPRING CLEAN

You can't do anything useful with a dirty bike, so wash it. Not just the standard post-ride swill off either, we mean the real hour-long scrub fest. Using water as hot as you can stand and some sort of cleaner like Muc-Off or Fenwick's will help move the stubborn stuff, as will some mild washing up liquid. Get rid of all that accumulated filth.

5 PICK AND POKE

Use some spray degreaser, an applicator straw and a rag to help with cleaning the jockey wheels, and use a thin flat-bladed screwdriver to pick out the hard-to-reach gunge from the nooks and crannies.

6 CABLE GUY

Put the rear derailleur onto the largest rear sprocket. Then, without letting the rear wheel turn, shift to the smallest rear sprocket: this will free up the cable and allow you to release it from the cable stops. Slide the outer casing back to expose the inner gear cable and then use a light lube on a rag to lubricate and clean the cable. Replace if worn, damaged or rusty.

7 WHEEL CARE

As the sun comes out you'll want to get rid of those deeply treaded mud tyres and fit something lighter and faster to match the drier trail conditions. Remove the old tyres, refit wheels, check the rims for dings and the spokes for even tension. Rim walls can be gently tweaked with molegrips.

11 FLAT FREE 2

If you're proofing a tubeless or tubeless-ready tyre, then remove the core from the Presta valve and inject the fluid (50-80ml for tyres up to 2.3in wide). If your tubeless valve doesn't have a removable core, unseat and pop an 8in section of tyre bead from the rim and pour the fluid in. Make sure it is well shaken to evenly distribute the particulate suspended in the fluid, otherwise it can bung the holes.

12 FRESH PADS 1

Winter is hard on the bike and especially so on brakes. Whip out the old pads, and give the insides of the calliper a clean to get rid of all the old brake dust and grime that hides in there. Use some cotton buds with a small amount of spray degreaser; this will cut through accumulated dirt without getting degreaser everywhere.

13 FRESH PADS 2

Then check the pads for signs of wear and/or damage. Damaged or thin pads – less than 1mm of pad material – should be replaced. Check the return springs as well and if they're bent, broken or collapsed in any way, replace them.

- ✓ Allen keys
- ✓ Tyre sealant
- ✓ Rags
- ✓ Cleaning kit,
- ✓ Cotton buds
- ✓ Spoke key

WORKSHOP WISDOM

Regular users of hydration packs will already know what a disgusting and potentially germ-laden environment the inside of a bladder can be – hydration pack bladder that is. Give your bladder, hose and bite valve a wash in a solution of water and sterilising fluid (such as Milton). Ensure that any telltale dark patches (mould) are removed before using it again.

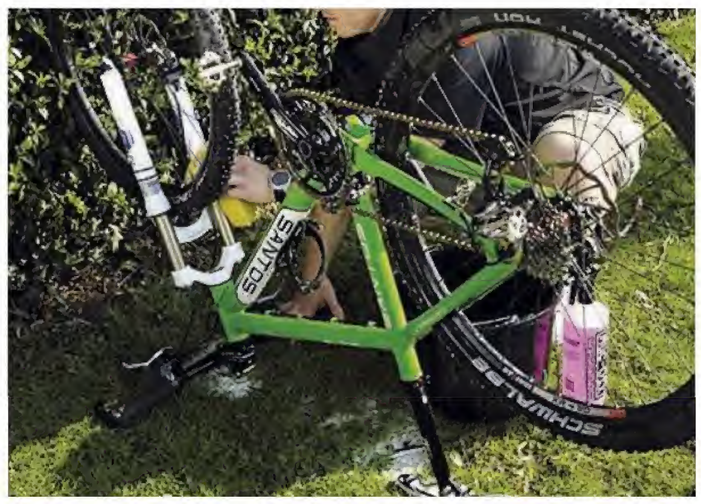
Bar ends may not be the sexiest add-on in the world – and they fell out of favour for a number of years – but there aren't many upgrades you can make for under £20 that have the same positive effect on your riding, as they add upper body power to your climbs and comfort on flatter trails. There's still the 'riser bar with bar ends' fashion dilemma you'll have to wrestle with, but if you can put that aside it's a component add-on worth considering, especially if you ride XC.

2 SPONGE IT OFF

A big soft car-type sponge is the best bet for generating the right amount of suds. The surface is abrasive enough to remove the grime but not to damage the paint. Don't touch the chain or gears with the sponge, or you'll smear greasy marks back onto the frame.

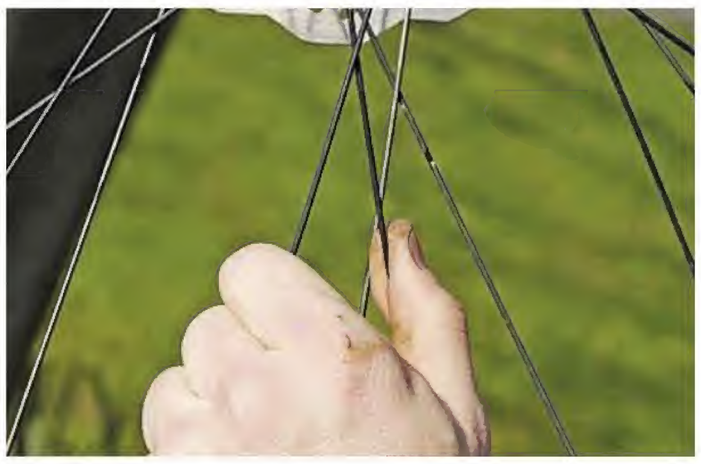
3 BRUSH UP

While washing pay particular attention to the chain, the rear sprockets and front derailleur using a brush. Work the bristles into the chain and the rear sprockets, remembering to check the rear sprockets from the reverse side of the wheel. Often dirt squeezes through the gaps and gets lodged in the back of the cassette.



4 FRAME CHECK

With all the dirt gone and the bike wiped down you can get a good look at your frame. Hopefully all you'll see is bright undamaged paintwork, but in some areas – like under the junction of the head- and the down-tubes – you might find cracks or damage from crashes, or just from old age. Unfortunately, damaged frames are dangerous and should be binned.



8 TENSION

Spoke tension isn't something you'll need to check every ride, but it's worth doing as part of your spring clean. Grasp a pair of spokes to check for even tension, and continue checking them in pairs around the wheel. Loose spokes should be adjusted an eighth of a turn at a time. Unless you know what you're doing, get the bike shop to sort spoke tension or wheel trueness issues.

9 FITTING TYRES

Why not try a pair of really lightweight tyres this summer? They roll fast and maximise every ounce of your energy. Observe the tread direction when fitting tyres, as even low-profile summer ones will have an optimum operating direction for low-rolling resistance. Start with the tyres pumped up a bit harder than normal to ward off snake bites, and then gradually reduce pressure for added grip as you get used to tyres with thinner sidewalls.

10 FLAT FREE 1

Help ward off punctures by protecting your tyres with liquid sealant. Any of the big names – Stan's, Bontrager, MSC Black Seal or Sludge – work well for tubeless or tubeless-ready set ups. Ensure the liquid is well mixed and add about 50ml to each tyre for average 2.2in treads. If you want to proof inner tubes, buy the road bike version of Sludge which, unlike other sealants, can be inserted through the valve cores of Presta valves.

14 READY TO PUMP IT

Summer means thinner tyres and, even with sealant fitted, you might need to top up the pressure so carry a mini pump with you. The best way to keep one to hand – it's easy to forget to put it in your pack – is to use one of the models that comes with a frame mount clamp. Usually fitted under a bottle cage, this is a tidy way to keep your pump handy on any ride.

15 BOTTLE LOSS

Many riders don't even have one bottle cage fitted, let alone two. But even for hardcore hydration pack users, we highly recommend fitting at least one – and preferably two – bottle cages to your frame. Even if you don't use them for fluids, they're dead handy for carrying your light battery, spare food and tyre repair spares in an old bottle.

16 MORE NEW PADS

Given that one of their jobs is to keep sweat from dripping in your face, we pay little attention to the pads inside our helmets; most are removable and machine washable. You wouldn't wear the same pants for a year, so why do it with your helmet? Replacement pads are available from your local bike shop; buy a few sets and rotate them, so you'll never have to put on a sopping-wet helmet again.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

60-120 mins

£0-100

WINTERISE YOUR BIKE

Winter brings its own special challanges for you and your bike. Here's how to set up your ride to cope with all the mud and slop that's waiting on the trails

SEAT TUBE SEAL UP

It's simple but will help keep mud and water out of your frame. Remove your seatpost and wipe grease around the inside of your frame's seat tube. It only needs to be a light covering, not a smothering, as too much will stop your seat clamp from working effectively.

WASH AND GO

It's blatantly obvious, but keep your bike clean. A quick wash and lube of the chain after every ride will keep your bike running smoothly for far longer than if you decide to leave it unwashed every now and then. Muc-Off cleaner does a top job of removing dirt, and their wet lube works a treat through winter.

RUBBER LOVING

Tyres with a more aggressive, deeper tread will cut into the mud and slop, giving you more grip and the ability to hit the trails just as hard as in summer. If you're already running gert knobblers or don't fancy splashing cash on new rubber, try dropping a few PSI from your tyre pressure. Just be mindful that you're increasing the risk of pinch flats.

SPIN SPIN SUGAR

Gritty hub bearings can cause a whole heap of problems, so keep as much water and grime out of them as possible by packing the bearings with a good grease before winter gets too set in. Your freehub body will benefit from a greasing too, but with a thinner lube that will still allow the inner workings to do their job.

1. Using a Stanley knife blade at the outer edge, between the bearing and seal, carefully lift the seal away from the bearing.

2. Squeeze some fresh grease into the bearings using a grease gun.

3. Sit the seal back onto the bearing and use your thumb to push it back into place. It should 'pop' back in to its seating. If you can get to the other side of the bearing, repeat the process there. the chain.

EVERY TRIP

If you can, give the chain a good clean and lube up before winter starts. Every time you wash your bike, lube the chain.

1. Clean the chain. Run it through a rag to get rid of any excess water if you've just washed the bike.

2. Douse the chain in a wet lube like the Muc-Off Wet Lube, applying it to the inner side of the chain where it contacts the rings and cassette.

3. Run the chain through a rag to wipe away any excess lube from the chain.

- ✓ Old inner tube
- ✓ Scissors
- ✓ Bike cleaner
- ✓ Brush
- ✓ Rag
- ✓ Snips
- ✓ Grease/grease gun
- ✓ Wet lube
- ✓ Cable ties
- ✓ Stanley knife

WORKSHOP WISDOM

Working through the list here will take you a couple of hours, but that doesn't mean to say your work is done! Maintenance is a whole lot easier and generally doesn't need doing if your approach is little, but often. That post-ride wash and lube will make a world of difference, and tackling issues as they come up will mean you can keep having as much fun as possible on the bike, rather than end up with an arm-length list of things to sort out come spring time.

DON'T LET GO

Are your grips worn out? They're one of your main contact points with the bike, and if your hands are sliding then you won't be in total control. Lock-on grips are always best for the winter as moisture won't affect them if it gets underneath. If you're using push-on grips, try gluing them in place with Renthal Grip Glue.

CABLE CHANGE

The grit and mud of winter quickly finds its way into your gear cables if they're not well lubed and kept clean. Treat your bike to new gear cables now, and fit them with a good amount of lube in there. This will keep as much grit out as possible and keep the gears shifting smoothly for longer.

GET PROTECTED

Cable rub is one of winter's worst traits, so fit patches where the cables come into contact with any area where rubbing could happen. It'll save your paint and avoiding possible structurally damage your bike. If you want a more permanent solution, the guys at invisiFRAME will completely wrap your bike in protective tape.

SLIDE AWAY

This won't be for everyone, but if you're confident with the toolbox, give your forks a lower leg service and lube. It won't take too long and you'll be rewarded with forks that'll be smoother through their travel and also keep water and mud out more effectively. A good suspension grease on the seals and the manufacturer's specified lower leg lube is all you'll need.

BLURRED VISION

A front mudguard makes a lot of sense in winter – it'll keep spray and mud out of your face and eyes, meaning you can concentrate on the job in hand. The POWA DFender on the bike here is the best we've found, but it's not cheap. A cheaper option that works well is the Marsh Guard at £9.99, or you can make your own DIY version out of an inner tube. Here's how...

1. Measure and cut a piece of old inner tube long enough to bridge the gap between your fork arch and crown.
2. Cut two small slits in one end of the rubber. Pass cable ties through the slits and attach the tube to the fork crown.
3. Pull the tube so it's under tension and mark where you need to cut the slit to attach the tube to the fork arch. Release the tension, cut the tube, then re-tension and cable tie it to the fork arch. Get riding!

PEDAL ESSENTIALS

Your pedals are the other main contact point with your bike, so give them some TLC before winter starts. Check with the manufacturer on how to perform a basic pedal service, giving the bearings and seals some fresh grease to help keep the winter on the outside. If you ride flats and are missing pins, source some replacements as you'll be needing as much grip as possible when the trail's deep in muck and goo.

SLOW IN, FAST OUT

Mud and grit are top culprits for wearing down brake pads fast. Check your pads still have plenty of braking surface left, and it's worth keeping tabs on them, checking after every ride too. We like to plan ahead and get some spare pads for the toolbox so you'll never be out of action.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

60 mins

£10 and up!

WINTER PREP FOR THE ROAD

Get the best from your winter riding and make sure that your bike survives with these essential tips to prepare your bike for wet and salty roads

When the winds turn to chilly northerlies and darkness more swiftly overpowers daylight, you know it won't be long until the arrival of more rain, possibly snow, and the colder temperatures which inevitably bring out the gritting lorries. This is the time to make your bike winterproof.

These are tried and true methods, with an old timer trick or two, and a few more obvious procedures. Over the page you can find our best lubing tips to complete the job. For those of you prepared to go the extra mile in order to protect your bike, performing all of these steps can significantly prolong its life, but even adopting just one or two will help your enjoyment and safety.

Most of these steps should be within reach of the confident DIY cyclist, and the tools required are pretty straightforward, but if in doubt an experienced shop mechanic can work wonders with a seized bottom bracket or really close-fitting mudguards. Bring on the winter!

1 DRILL BABY DRILL!

Drainage is essential for keeping the inside of your bike and bottom bracket dry. Drilling what is in effect a second hole (the cable guide screw being the first) should pose no structural problems on steel or aluminium frames, but might nevertheless have warranty repercussions. This will definitely be the case for carbon, so while we feel it can still be useful on some of them, the final responsibility rests with the person giving the okay to drill. Remove your bottom bracket first, and take the opportunity to clean and inspect it for corrosion. Make a starter mark adjacent to the cable guide, but as close to the centre of the bottom bracket as possible before drilling. Use a 5 or 6mm drill. Finish with a bit of touch-up paint.

5 FREEDOM FROM FLATS

Getting a flat on the way home during a cold, dark and rainy night is no fun, and repairing it can be made even more difficult with a multispeed or dynamo hub. The onset of winter brings thorny hedge clippings and sharp road grit too, making some kind of puncture protection essential. Install Slime-filled tubes, polyurethane protective strips (Mr Tuffies) or Kevlar belted tyres; the small sacrifice in ride quality and weight is well worth it. Remove wheels, tyres and old tubes. Inspect your rim strips for wear and make sure they adequately cover the spoke holes. Inspect your tyres for thorns or glass if you plan to re-use them. Re-install with the appropriate protection, and confirm correct bead seating while inflating, especially at the valve.

6 LEATHER WEAR

Saddles take a real beating in the winter, especially leather ones, particularly if you ride without mudguards when the gritty slurry thrown up by the back wheel can really take its toll on the saddle's finish and shape. The surface polish gets scuffed, and the protective oils get washed out. Start by cleaning the underside with a stiff toothbrush and a rag to loosen and remove any dirt. Grab a generous dollop of Brooks Proofide leather saddle dressing and apply a substantial coating to the underside of the leather; this will seal it from the elements and be drawn in by the heat generated by riding. After a really wet ride, soaked leather that has lost some of its form can be re-shaped with firm hand and thumb pressure before allowing it to dry naturally.

7 SIGNED AND SEALED

Cable wipers and seals are a simple way of keeping your shifting smooth and slick regardless of the weather. Make sure that the end caps match the diameter of your outer cables. Snip off the end cap and loosen the anchor bolt holding the cable. Withdraw it from the mech and slide off the outer in question. Replace your standard end caps with the new ones, and slide the rubber wiper onto the cable first before threading it back into the outer with the help of a few drops of oil. Anchor and adjust. There's more than a good chance that you might need to replace your cables at this point, because they'll have been damaged by the anchor bolts and could be frayed, so give them a good inspection. If they do need replacing, choose cables that'll withstand wintry weather (see step 8).

- ✓ Shimano splined socket
- ✓ Lockring
- ✓ Pin spanner
- ✓ Crank extractor or external cup splined type spanner
- depending on BB
- ✓ 8mm or 14/15mm socket 3, 4, 5, 6mm Allen keys and/or 8, 9 and 10mm standard spanners
- ✓ Phillips or flat screwdriver,
- ✓ Pliers
- ✓ Small hacksaw
- ✓ Frame Saver Slime tubes
- ✓ Jagwire cable wiper seals
- ✓ Mudguard flaps
- ✓ Rustless chains
- ✓ Car wax or other
- ✓ Stainless fasteners
- ✓ Kevlar tyres and mudguards

2 INSIDE JOB

Steel and even aluminium frames can corrode from the inside out, and oxidation can spread from scratched braze-ons and eyelets. One useful product is Frame Saver, available in a small can with a pipette with which you can treat approximately two frames; make sure to wear protective eyewear in case it blows back at you when spraying. You can also use 30wt oil or thick chain lube with a bit of WD40 to help spread it around. Make access and handling easier by removing the cranks, bottom bracket and wheels, then dribble or spray the fluid into the tubes and plug the BB and seat-tube with rags or paper. Now move the bike around so as to coat the inside evenly. Allow it to settle and then wipe off excess.

3 SEAL OF APPROVAL

After coating the inside of your frame with either Frame Saver or plain old oil, one good tip is to seal it up. An old cycling buddy and roughrider, known as the Ragin' Cajun in some cycling circles, would perform this prep job before heading out on epic tours up the Alaskan highway and beyond the Arctic Circle. You might not be making for such inhospitable climes, but it's still a useful trick. Use matchsticks or kebab skewers depending on the size of the vent holes. Dip the wooden end in a bit of contact cement or superglue, poke it into the hole, then break it off or snip it with wire cutters. Follow up with a dab of enamel or touch-up paint. Make sure to install greased bolts in all the spare eyelets in order to prevent ingress of water.

4 FRIENDLY FENDERS

Mudguards are probably the most important winter accessory. They'll prolong the life of your bike, components, and in particular your chain, not to mention improve your comfort. Check for clearances – occasionally a small cutaway might need to be made in order to clear the brakes; mark and cut carefully using a small hacksaw. For tight clearances use SKS Race Blades. P-clips can be used when eyelets aren't available. Don't forget mudflaps: these simple devices can help keep your feet a lot drier, and are useful as a courtesy to riders behind you, especially on group rides. Some brands attach simply by means of two bendy tabs, others require a hole to be drilled and installation with a screw and nut.

8 ANTIOXIDANTS

Stainless steel items like gear and brake cables, chains, fasteners and even aftermarket ball bearings can help keep your bike rust-free and looking good. Most bike shops will stock a selection of stainless fasteners in 4, 5, and 6mm thread sizes in either Allen or standard versions, along with washers and Nyloc nuts. Grease well and replace as required. A stainless steel chain is certainly worth it if you have the budget, and if you do replace your chain it's a good idea to include a Powerlink type connector to make it easier to remove and clean. Install stainless cables on brakes and derailleurs, especially if you're adding those little wipers or a new piece of outer. Make sure to add a dab of oil, as it's still essential to reduce friction wherever metal is concerned.

9 TIME FOR REFLECTION

This bit of advice might be unpopular with the 'sportier' riders among you, but when winter hits, so does early nightfall, and this simple step can be a lifesaver on those occasions where your batteries run out, or you've left it too late to head home with night closing in. So dig out those old reflectors if you still have them and put 'em back on! If you don't have any, some shops are happy to give them away, but expect to pay at least a little something for them. Pedal reflectors are particularly visible, and adhesive reflective patches make a good alternative if you want to preserve the clean lines of your bike, so install them on seatstays, fork blades, on rims between spokes and even on helmets.

10 SIMONIZ IT!

Old fashioned but effective: apply a generous layer of car wax to the entire bike, especially under the down-tube and in the bottom bracket area. You can also treat components, even spokes. Harmful grime, grit and dirt are prevented from gaining a solid foothold thanks to the super slippery surface created by the wax. Make sure the bike is clean first, then simply spread the paste or liquid with a cloth, allow to dry to a haze, and wipe off. Repeat, then buff to a high polish. You can also use some of the spray-on after-wash coatings based on light oils or silicone that are currently available (X-Lite Bike Spray, for example); these involve a bit less work but might require more frequent cleaning and re-application. Avoid braking surfaces!

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

10 mins per process

Free!

TRICKS OF THE TRADE

Here's how to master four jobs professional bike mechanics do almost every day

REPLACING INTERNALLY ROUTED CABLES

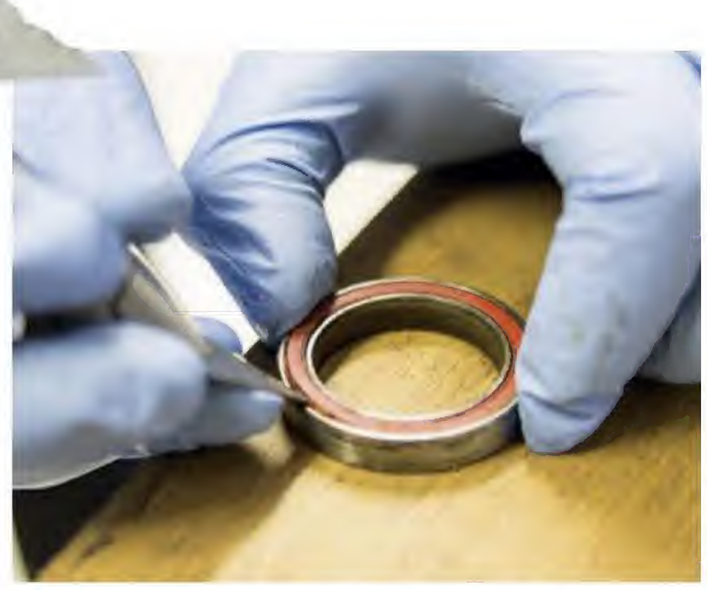
1A REMOVE CABLE

If cables are already fitted, it's important to leave the inner cable fixed in the shifter to begin with and only remove the outer. (If cables aren't already fitted, skip to 1b.) Undo the cable clamp bolt on the rear mech, grasp the outer cable where it exits the frame at the rear and pull it all the way out. You may need to do this in stages if the cable continues through the stays.

GREASING SEALED BEARINGS

2A LOCATE BEARING

When sealed bearings start to feel slightly worn, their life can normally be prolonged with a fresh flush of grease. Mechanics will do this to most of your bike's sealed bearings during a service. To start, locate the bearing you want to grease up. It doesn't necessarily have to be out of its seat, but you'll be able to do a more thorough job if you can get to both sides of it.



2B REMOVE SEAL

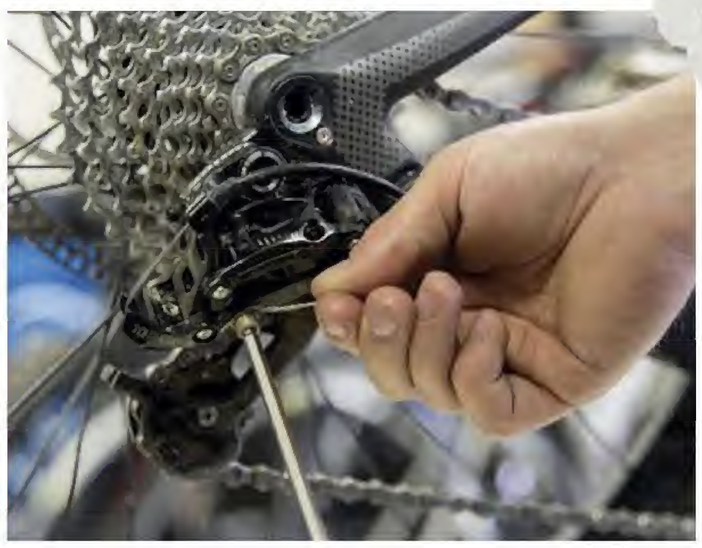
Carefully insert a sharp knife blade in between the outer edge of the rubber seal and the outer race of the bearing. Use a twisting motion to pop the seal upwards, then remove it with your fingers, being careful not to bend or damage the seal. Gently repeat this on the other side of the bearing if you can get to it easily.

2C REMOVE DIRT

Using a light lubricant such as WD40 with the fine spray tube attached, spray the bearing's inner race to clean out the old grease and any dirt that may have got past the seals. If you can, check that the bearing spins freely too. Using a grease gun, fill the bearing's inner race with high-quality grease.

3C SHIFT THROUGH GEARS

Let go of the mech and, while turning the cranks, shift up and down through the gears to let the cable sit itself in place. Then shift back to the hardest gear and repeat the stretching procedure from step 2. Now go ahead and set up your gears normally, starting with adjustment of the high and low stop screws.



3D LOOSEN CLAMP

There should now be a small amount of slack in the cable. Loosen the cable clamp bolt on the mech, tension the cable and retighten the bolt. Make sure the end of the cable is cut tidily and has a cable end cap crimped in place to prevent fraying. Repeat steps 1–4 with the front mech (if you have one).

SHORTENING A ROCKSHOX REVERB HOSE WITHOUT BLEEDING IT

4A CUT HOSE

Turn the return speed adjuster on the lever fully anticlockwise (the opposite direction to the '+' arrow). Decide how long you want the hose and measure this distance from the post. Use a hydraulic hose cutter to cut the hose at the lever end, holding the post end of the hose still so you don't lose any hydraulic fluid.

- ✓ Grease and grease gun
- ✓ Hose cutter
- ✓ Torx key set
- ✓ Allen key set
- ✓ Rags
- ✓ Insulation tape
- ✓ Sharp knife
- ✓ Wire snips
- ✓ Cable cutters
- ✓ Light lubricant
- ✓ Bike cleaner
- ✓ Pliers
- ✓ Welding rod

WORKSHOP WISDOM

These small tricks of the trade save professional mechanics a big chunk of time, as well as making potentially annoying jobs incredibly simple. Just bear in mind that they may not be the manufacturer's recommended way of doing things. They're all relatively easy with some mechanical know-how, and we've skipped on some very basic stuff in the assumption that you're already capable of doing the job in question and just want to learn an easier or quicker way of doing it. As always, if you need help, your local bike shop should be able to rescue you from any sticky situations, as well as show you where you went wrong – handy to know for next time!

1B THREAD NEW CABLE

With the outer cable removed, give the exposed areas of inner cable a wipe, then slide the new outer on to the old inner cable, working from the rear mech forwards. Once the whole outer cable is in place, remove the old inner cable from the shifter. Thread a new inner cable through the shifter and outer cable, clamp it to the rear mech and index your gears.

1C LOCATE EXIT POINT

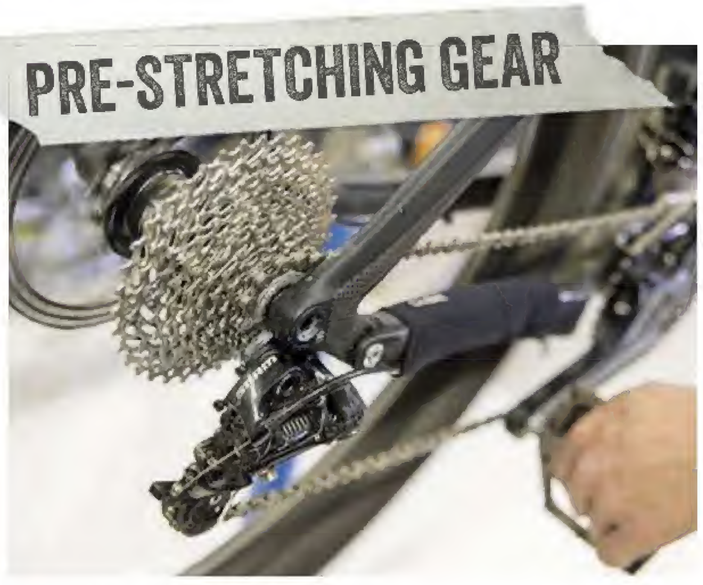
If there's no cable in the frame already, it can be difficult to locate the exit point when threading a new outer cable through. One trick pro mechanics use is to put a slight bend in a length of welding rod, around 5cm from one end, and thread this through the frame instead. Once you've managed to poke the end out of the cable exit, make sure to keep hold of it.

1D ATTACH CABLE

Use a small amount of insulation tape to attach either the inner or outer cable to the rod, then carefully thread it back through the frame and out of the cable entry point, always feeding the cable rather than pulling the rod. If you don't have any welding rod, you can use an inner gear or brake cable instead – in some cases, these works better due to their flexibility.

2D REPLACE SEAL

Sit the seal in place on the side of the bearing you've just greased. Use your thumb to pop it into place, pressing lightly and evenly. If you can reach the other side of the bearing, repeat the procedure there. Check that the bearing still spins freely and feels smooth.



3A GET IN TOP GEAR

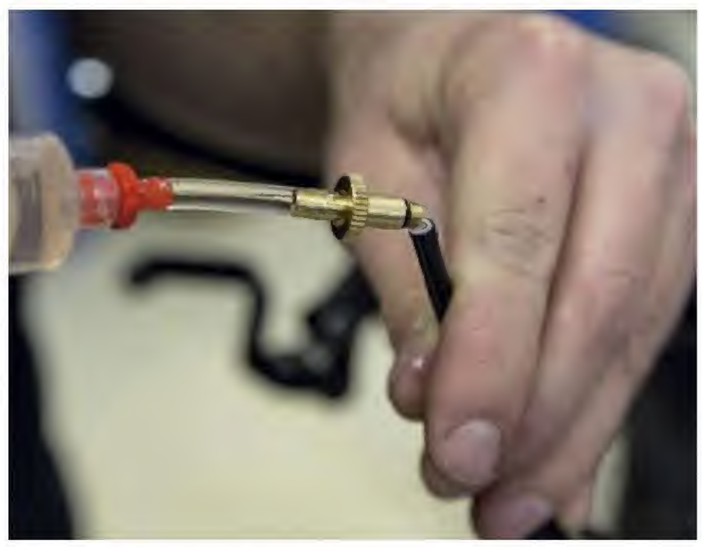
After changing inner cables, it's a good idea to pre-stretch them so you don't have to make any adjustments after the first couple of rides. This needs to be done before you index the gears. Make sure the cable is correctly routed to the mech and that you're in the top (hardest) gear at both ends (shifter/mech).

3B CHECK TENSION

Make sure there's only minimal tension in the cable. Without turning the cranks, shift down with your right hand (as if you were trying to move the chain on to a larger sprocket) while holding the mech in place with your left hand and resisting the cable movement. You should be able to feel the cable stretching.

4B REMOVE WASTE HOSE

Leave the main section of hose sat with the cut end facing upwards. The 'waste' piece of hose will still be attached to the lever. Rotate it anticlockwise using a pair of pliers, and it'll slowly unscrew from the lever's threaded hose barb. When it's almost off, hold a finger over the cut end to avoid any spillage.



4C APPLY REVERB OIL

Remove the waste section of hose and put it in the bin. Make sure the fluid is still level with the top of the cut on the remaining section of hose. If you've lost some, apply a drip of Reverb Oil to the end of the hose. A tap with a finger should dislodge the small air pocket at the top of the hose.

4D REATTACH HOSE

Use a Torx T25 key to remove the lever from your handlebar, being careful not to actuate the post. Press the hose barb into the shortened hose, then rotate the lever clockwise until the hose is fully threaded on. Refit the lever using the Torx key.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

30 mins

Free

HOW TO TROUBLESHOOT A NOISY BIKE

Silence is golden... Prevent annoying squeaks and creaks with our tips to help you keep your bike running smoothly and quietly

1 CRANK BOLTS

A common cause of creaking is loose crank bolts, particularly on square taper and splined axles. Two-piece-style external bottom bracket (BB) cranks, such as Shimano's Hollowtech II, can creak if pinch bolts are loose. Remove and clean the crank bolts. It's worth checking that your BB hasn't developed bearing play; if it has, replace it. Cranks with separate spiders should be checked for tightness because loose spiders will creak.

5 SHOE CLEATS

Clipless pedal systems rely on the secure interface between the shoe cleat and the pedal itself; sometimes a cleat can work loose and cause noise. Use grease or Threadlock on the bolts and tighten them fully. You might find that you've also either worn the cleat out or the out/midsole of the shoe to a point where noise is generated with each stroke. Go shopping for fresh ones.

6 PEDALS

Other causes of noise can include loose/improperly adjusted pedal bearings, and worn bearings. Spinning the pedals and getting a crunchy feeling spindle will diagnose a bearing problem. Adjust/replace the bearings as necessary and/or give the pedal a thorough service. Lubing the pedal mechanism and its springs can help quieten things down too.

7 BOTTOM BRACKET (BB)

If a bottom bracket isn't snug against the BB shell there can be movement between the internal frame threads and BB threads. Check the cranks are properly on the BB splines and cinched home. A bit of grease or copper slip on the spline/crank interface can help remove crank creak. Check they're tight and use Threadlock if necessary.

11 CLIPPING CHAIN

In most cases resolving this is a matter of adjusting the shifter barrel adjusters: shift into the largest chainring and the smallest rear sprocket, then shift one gear at a time. If it doesn't shift then there is insufficient cable tension (add a quarter turn on at the shifter barrel adjuster). If it jumps a gear, there's too much tension (back off the barrel adjuster). Listen for the shift and when everything is silent and shifts as it should, it's set up.

12 SLAP-SLAP-SLAP!

Chain slap is noisy and damages the bike as it takes chips out of the chainstay paint job. To keep things running smoothly and protect your frame, either buy a Neoprene chainstay protector or make one from an old inner tube: cut it into a section about half as long again as the chainstay section you need to protect, cut it along its length, then wrap it along the chainstay like a bandage. Secure with small zip ties and/or electrical insulation tape.

13 STEM & HANDLEBARS

A loose stem or bar can creak, particularly if the bolts lack greased threads as they may not tighten properly. Whip them out, clean them (if necessary) then put grease on the threads, and re-secure. Ensure you do bolts up bit by bit, rotating around each of the bolts in turn – don't just cinch one up to torque and then the other. Don't over tighten clamping bolts – this is especially important when fitting carbon bars.

- ✓ Allen keys
- ✓ Torx keys
- ✓ Cable trimmers
- ✓ Lockring tool
- ✓ Wrench, grease
- ✓ Anti- seize
- ✓ Lube
- ✓ Copper slip
- ✓ Disc pad spreader
- ✓ Chain tool
- ✓ Rags

WORKSHOP WISDOM

Dry parts can squeak and squeal but this can be solved with the application of some lube or grease to keep things working slickly and smoothly. Parts include: the chain, jockey wheel bearing/bushings, pedal springs, pedal plates (use WD-40 or GT-85), and wheel skewers (use grease).

Even if you've cinched everything up to torque and Threadlocked all that needs to be, you may still hear creaking. This can be due to contaminated grease or grime in between the mating surfaces of things. Cleaning everything down to bare metal to remove grime before reassembly and greasing or Threadlocking will help eliminate these creaks, which will also mean quieter running and longer life all round. Degreaser or a parts bath to help penetrate stubborn dirt can all help.

2 CHAINRING BOLTS

Chainring bolts secure the chainrings to the crank spider and can vibrate loose if not properly cinched up. Use a 5mm Allen key or T-30 Torx to check each bolt. Hold the back chainring nut to prevent spinning with the right tool, like Park's CNW-2, and cinch each chainring bolt up to about 60lb/in. Don't over-torque the bolts, especially if they're aluminium, as the heads can shear off. A dab of Threadlock will help prevent the bolts undoing.

3 DISC BRAKES 1

Disc brakes can rub if the calliper isn't aligned with the disc. Post Mount brakes are simple to adjust, but International Standard (IS) are more fiddly. If using PM, loosen the calliper bolts, pull the brake lever on and, while keeping the lever on, tighten the calliper mount bolts. Release the lever: the calliper should be aligned. IS mounts don't allow for lateral adjustment so use washers to space out the calliper from the frame/fork tabs as needed.

4 DISC BRAKES 2

Brake squeal can be caused by the pads vibrating slightly while braking. Check they're properly installed and secured, that the pad spring is properly fitted and, if needs be, apply a very small amount of copper slip to the reverse of the pads (NOT the side with brake compound on) as this can help damp any vibration. Don't use too much or use grease because this will turn to liquid with heat and cause the brakes to fail.

8 FRAME FITTINGS

An annoying rattle can simply be loose frame bolts or fitments. Check all bolts are tight – again, Threadlock could come in handy. If cables are rattling excessively, consider using cable donuts (available loose from most bike shops). Unthread the cable inner from the outer, thread on as many donuts as necessary, rethread the remainder through the outer, then cinch up and readjust the mechs/brakes.

9 STIFF CHAIN

A stiff link can cause noise. Isolate the stiff link and move to the middle of the bottom chain run. With the chain in both hands (as pictured), flex the chain to work the link loose. Or, place the link in a chain tool and run the chain tool pin up to the tight pin (note the handle's position), turn the handle one-eighth to one-quarter of a turn clockwise to press on the rivet to spread the chain. Remove the tool and check the link. Repeat until it's no longer stiff.

10 SEATPOST & SADDLE

A creak when pedalling hard in the saddle – when climbing, for instance – is often due to the saddle rails not being clamped tightly enough in the seatpost clamp. Securing them should sort this out. If they're torqued correctly and there is still creaking, it may be that the seat clamp binder (either a bolt or quick release) may need lubing to prevent dry creaking, tightening up slightly, or both.

14 RATTLING COGS

Rear cassettes rarely work themselves loose, but if they do you'll notice rattly and irregular shifts and, depending on how loose they get, potentially ghost shifts, too. Take the wheel out, grab a lockring tool and a suitable wrench, and cinch the lockring up tight. Our tip is to get a lockring tool with an integrated handle (saves looking for a big wrench) and a guide pin to fit in the quick release hole (helps ensure an even fit).

15 HEADSET

If there's play in the headset undo the stem steerer clamp and tighten the headset bearing preload cap with an Allen key. If there's still play the bearings could be knackered, or the headset cups could be fitted incorrectly. If the latter is the case, check the head tube isn't ovalised. If the head tube's true, remove the headset cups using a headset cup removal tool, then grease and refit the cups with a headset press.

16 WHEELS

Creaking wheels is usually a sign of loose spokes. Spokes could be moving in the rim or rub where they cross in the wheel build. Add tension if you're competent in wheel building and/or truing. If not, take the wheel to a reputable shop to sort. Rattling in the rim is usually debris that has caught there. Take the tyre, tube and rim tape off and shake it out through a hole in the rim bed. A magnet may help, or use a vacuum cleaner to suck it out.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

VARIOUS

Free-ish

EMERGENCY REPAIRS

How to fix your bike when disaster strikes and you're miles from home, and what tools to carry to fix any immediate problems

You're midway through one of the best rides you can remember when fatigue and a momentary lapse of attention cause you to edge your front wheel into the rear of your riding buddy's bike, catching his derailleur in your spokes. The consequences are a buckled front wheel and a broken rear mech 30 miles from home.

Rather than facing the prospect of having to rely on thumbs and the generosity of strangers, or mobiles and a friend, most of us would prefer to be able to rely on our own skills to get us home.

We think we can help you do just this with this handy list of essential survival tips. Although by no means exhaustive, we've tried to highlight the most common and likely occurrences and technical difficulties. What's certain is that if you ride a lot, the odds of experiencing these scenarios will only increase with time, and a little knowledge might just go a long way.

3 TOP TIPS

- **Purchase a** couple of spare normal spokes of the right length, with nipples, and tape them or zip tie them tightly under the left chainstay to keep them out of sight – they are handy to have in reserve.

- **Replace a** couple of your shorter 5mm bottle-cage bolts with longer ones that are 3-4cm; these can be used on many modern twin bolt seatposts or clamps.

- **Fill your** tubes with Slime or other tried and true tyre sealants; this can be extremely effective when you get caught out by recently trimmed hedgerow debris. If you don't want to purchase pre-filled tubes you can inject them directly into Schrader or two-piece Presta valves, or if you only have one-piece Presta valve tubes, through a small self-inflicted puncture that you then patch afterwards!

4 BROKEN REAR MECH OR GEAR HANGER

If your derailleur or hanger is broken beyond repair, you can remove it entirely and then shorten your chain using those handy master links in your survival kit. This repair depends on a bit of luck and preparation. Having a multi-tool that includes a chain breaker will make life a lot easier, though you might not be able to get ideal chain tension if you have vertical dropouts. Try to get the chain line as straight as possible.

5 BOLT-ON REPAIRS

You can pinch a bolt from a place on the bike where it can be spared and use it where it's more critical in an emergency, for example, a rack strut if you're on a heavily laden touring bike or on the water bottle cage bolts. But be careful and go easy until a permanent replacement can be found, especially if you think the carbon parts might be damaged. Run a cloth lightly over suspect areas to check for a cracked surface – any small cracks will pull the cloth's threads.

6 BROKEN SEATPOST CLAMP

Re-attach a saddle to a seatpost when the clamp bolt has broken using those amazing zip-ties, but sit on it gingerly for the ride home. It's not perfect but better than sitting on a seatpost.

7 NO SPARE TUBES

Carefully tear the tube apart at the puncture, then tightly knot both ends; or do the same with your handy zip-ties. The tube will expand back into the tyre upon inflation, but go easy on the pressure.

Although most of you will have the basics of a pump, multi-tool and a spare inner tube or two, it doesn't hurt to make up a handy survival kit, small enough to be attached permanently somewhere unobtrusive on the bike, such as under the saddle. Use a small container, such as an old Tip-Top patch kit box or a 35mm film canister, and fill it with the following items, packing them in tightly so as not to rattle:

- ✓ A number of small and medium zip-ties
- ✓ A small piece of cut-down Biro casing wrapped with a length of duct tape
- ✓ One or two SRAM power links of correct width (9 and/or 10-speed). These links will work with most chains
- ✓ A small stretch of malleable wire (copper wire that can be twisted by hand is best)
- ✓ Some 20p or 50p coins
- ✓ You could also include a spare 5mm Allen bolt or two that's about 2.5cm in length, and possibly a 4mm and a 6mm Allen bolt if you have enough space to fit them in your container
- ✓ A piece of tyre casing or other suitable material cut down to about 5cm square
- ✓ A St Christopher medallion or lucky charm!

1 LOOSE JOCKEY WHEELS

Jockey wheels have an annoying habit of coming loose (usually because they weren't tightened correctly after cleaning). That piece of copper wire or the 5mm bolt you've got can now do its thing. Just loop the cable through the centre of the jockey wheel to keep it in place.

2 BADLY SLASHED TYRE

Use your handy duct tape and install a slightly larger piece overlapping the bead of the tyre, thus anchoring it securely when inflated. You might want to put a second layer, or even use the piece of cloth or tyre casing, which you also happen to have in your special box of tricks.

3 BENT REAR MECH OR GEAR HANGER

Place the bent rear mech into the smallest cog and big ring, then carefully and slowly pull the derailleur back into position. The cage of the rear mech should be in line with the smallest sprocket and check that it's pointing in a perpendicular direction to the ground. Be careful when selecting the lowest gear while riding afterwards though, as the derailleur might no longer be as well adjusted and could get caught in the spokes.

8 PRETZELLED WHEEL

If replacing a spoke won't do or isn't an option, a pretzelled wheel can be straightened sufficiently to get you home with a bit of technique and brute force. Place the wheel with the axle and high point of the buckle against the ground, then firmly push with substantial weight while gripping the rim on either side of the bent zone. You can focus and increase your leverage by using your feet with a stone or raised surface feature such as a kerb. Having your brake quick release open will reduce the chances of the wheel rubbing all the way home. Exceptions might be if you have a delicate carbon frame with tight clearances, where a few miles of tyre rub could not only result in a blowout, but put a hole in your chainstays, seatstays, or fork blades. Those spare coins might come in handy now if you forgot your phone or ran out of battery charge.

9 TYRE REMOVAL

A useful trick is knowing how to remove a tyre without the aid of tyre levers. First, make sure all the air is removed, then lean over the wheel, holding it vertically against the ground. Starting with both hands at the top, pinch and manipulate the tyre beads into the centre of the rim channel simultaneously, with both hands working downwards. As your hands meet towards the bottom you'll find that you've gained a substantial amount of slack, which should be enough to just pull the bead over the rim flange. If it's still a little tight, remove your quick-release skewer and use the lever – it works! Check the tyre for any debris before fitting the new inner tube. Run your hands all the way round the inside of the wheel rim to feel for anything that may have pierced the casing such as a thorn or piece of glass, taking care not to cut your fingers.

10 GEAR CABLE REPAIRS

If you break a gear cable, it's most likely to be the rear one, in the lever itself or near the head-tube where most friction occurs. Remove your front derailleur cable and carefully thread it through the right lever (you'll probably have to twist it in the direction of the winding to stop the strands from fraying). Tie it using a square knot onto the cable attached to the rear mech, about halfway along the down tube. Before tying the knot, push the mech up onto the big cog. This will take up any slack when it's released, though with a multi-tool you can take up the slack in the usual way. You can also immobilise the derailleur in a specific gear if all cable options are gone – jam a twig or piece of debris in the parallelogram, after placing it into the desired gear. A similar plastic widget is used by manufacturers when bikes are packed at the factory.

ROAD
OFF-ROAD

BEGINNER EXPERIENCED EXPERT

60-120 mins

£0-100

POST-CRASH SAFETY CHECKS

When the worst happens, how do you know your bike is still safe to ride? Here's how to crash and learn

Crashing is always memorable even if you manage to walk away. But when you've recovered, and are ready to ride again, you'll first want to make sure your bike is still safe to ride. Your most important tool is probably your eyes, to check relative alignments, although in this age of carbon and heat-treated aluminium, damage can be tricky or impossible to spot.

As well as the checks listed on these pages, attempt to determine the severity of the impact and the forces the bike will have been subjected to by visualising what the bike might have done. A mental playback of the event will help you perform a risk assessment of the potential level of damage suffered.

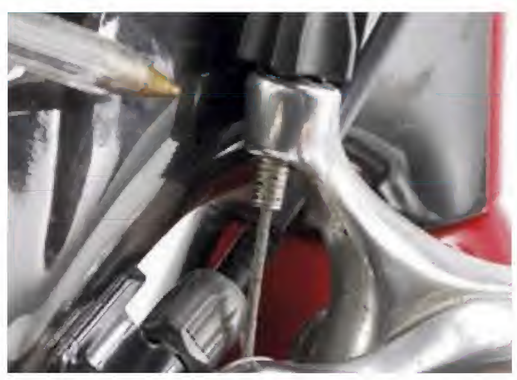
If in any doubt, though, take it to your bike shop and let the professionals sort it.

DERAILLEURS/CABLES

The rear derailleur often takes a beating, with the hanger bending inwards in the process. This is quite easy to spot from behind the bike, and can sometimes be straightened simply by grabbing the whole unit by the main body, when in high gear, and gently pulling it back into place. While you're at it, check for broken or bent barrel adjusters and set screws. The front mech rarely gets damaged, but sometimes band-on ones can slip sideways. Check for kinked cables and outers at cable stops. The plastic coating on gear cable outers can sometimes become fracture – Campag more so than Shimano. Replacement and adjustment is pretty simple.

WHEELS/TYRES

Spin the wheels and examine the gap between brake blocks; any drift of more than 2mm vertically or laterally will be felt at speed. Bent or loose spokes will be easy to see or find by squeezing in pairs or tapping with a screwdriver and listening for uneven or lower tones. Also check for cracks at the hub flanges and rim holes. Quick release skewers, especially the front, can get bent and suffer unseen damage that could lead to inadequate clamping force or sudden failure. Replace if they show any signs of damage or if the wheel was wrenched out of the frame. Also check for a wobble produced by the tyre rather than the rim; a strong impact can cause the casing to delaminate, producing a bulge in the tread line. Be on the lookout for sidewall casing cuts too, which could allow the inner tube to push through and possibly blow out.



BRAKES

Check for a bent brake arm at the barrel adjuster; this can often get bent as the front wheel gets turned around, causing the arm to strike the underside of the down tube. You also need to check that the down tube cable stops haven't been bent or squashed by the brake. Only attempt to pry them back open if you really have to, and do so by gently tapping with a Phillips screwdriver or tapered drift punch of slightly larger diameter.

- ✓ Old inner tube
- ✓ Scissors
- ✓ Bike cleaner
- ✓ Brush
- ✓ Rag
- ✓ Snips
- ✓ Grease/grease gun
- ✓ Wet lube
- ✓ Cable ties
- ✓ Stanley knife

WORKSHOP WISDOM

Once everything has been fixed and put back into place, go for a test spin on a quiet road and see how the bike behaves while riding no- hands. You should quickly be able to tell if everything is okay; the bike should track straight, not pull to the left or right, and be easy to flick in any direction. If it doesn't, it could be something as simple as a dimpled headset bearing race, or something more difficult to diagnose, which will need help from the pros.

FRAME AND FORK

First, clean your bike. While doing so, carefully inspect the entire surface of the frame, paying particular attention to welds or joints. Make sure the light is good; use a strong light source if it isn't. Bottle cage areas and the middle of tubes are susceptible to damage on carbon, but a small ding or dimple on a metal frame shouldn't be a major issue. Remove the fork and inspect, paying particular attention to the steerer, crown area and stem clamp zone. Check the dropouts by sight, then install a good, correctly built and dished wheel, making sure it lines up evenly between the frame or fork.

HANDLEBAR/STEM/ LEVERS/CONTROLS

Levers are likely to have been pushed inwards but they should still be tight, so grab and feel for any movement that would indicate clamp damage. Pull back the rubber hoods and check the body for cracks at the lever pivots. This is more common on Campagnolo levers, because its brake lever only operates in a fore and aft direction and can't rotate inwards when striking the ground. Check for damage hiding underneath torn tape, and remove the handlebar and steerer clamps to allow for closer inspection. If you see any cracks or kinks in any of the cockpit components, you need to replace them straight away.

PEDALS/CRANKS

Inspect the sides of your pedals for deep scoring or scratches, or cracked tabs at the front, the part that grabs the front of the cleat. Sit on the bike and spin the pedals backwards, looking out for any odd wavering in pedal feel, then swap your pedals with a set that you know to be good, and repeat. You should be able to determine fairly easily whether the cranks or pedals have any wonkiness issues.

ALIGNMENT CHECK

Check overall bike alignment by propping up or having someone hold the bike upright with the wheels as straight as possible. Kneel behind and in front of the bike at some distance (6ft or more) to allow a good line of sight: the wheels should be in the same plane, and you'll be able to spot anything that's out of whack. By using the old fashioned method of wrapping a string under tension from one rear dropout, round the head tube and back over to the other dropout, you can see if the rear triangle is still in line with the front; the distance between the seat tube and the string should be the same. A difference of up to 3mm or so is acceptable on non-carbon frames. Any more could be dealt with by the pros.

TYPICAL CRASHES

- **Overshooting the apex** of a turn and striking the kerb at an angle, coming off the bike before it carries on under its own momentum. The damage caused by this type of crash is often along the lines of displaced bars and STI controls, possibly bent pedals or crank arms, and maybe a bent rear mech and hanger.

- **Overlapping your front** wheel with someone's rear wheel while drafting, with your spokes catching the rear derailleur of the rider in front, with the ensuing tumble into the verge and hedges.

- **In these examples,** the rider will often have bailed before any important impacts occur. A potentially more damaging type of event will be the 'T-bone', a right angle collision at speed, with the full weight of the rider being borne through the front wheel, fork, frame and bars. Ironically, though touted as the wonder material, a carbon frame subjected to such severe forces could hide irreparable damage, and should probably be parked for good, while aluminium, titanium or steel frames might still be okay if no deformation, bulges or cracks are found. Get a second opinion from a pro.

LEAVE TO THE PROS

Many of the most common operations can be carried out by the home mechanic, but some are more difficult and potentially risky, including:

Brake/gear lever repair, such as replacing a cracked body

Cracks in non-critical areas on carbon frames; an experienced frame builder can drill-stop and epoxy minor damage

Frame repair, realignment or tube replacement

Repairs on high tensioned pre-built factory wheels

GLOSSARY

Learn the terms and never again have to retreat from a bike conversation with a baffled look

650B: Another name for 27.5in MTB wheels. Bigger than the old standard 26in, but smaller than 29in

700C: The metric version of the old 27in wheel size. Standard for road bikes

AHEADSET: Threadless headset standard that uses a top cap to tension the bearings by putting load through the stem and spacers on the fork's steerer. Now near universal

BEAD: The part of a tyre that tucks in the rim

BOTTOM BRACKET: The axle and bearing assembly the cranks fit onto

CADENCE: Term for the speed at which you are pedalling, in revs per minute

CASSETTE: The collection of rear cogs, typically with 7-11 gears (speeds). Written as '11-speed'. Various sizes available to suit the type of riding

CHAINRINGS: The front cogs, attached to the right crank arm. Come in single, double or triple versions. Multiply number of chainrings by speeds on the cassette for total gears

CHAINSTAYS: The tubes connecting the bottom bracket shell to the rear axle, with the chain running above and below

CLEAT: Attached to the sole of a cycling shoe to connect to clipless/SPD pedals for more control and efficiency

CLINCHER: Road bike tyres that use a regular inner tube

CLIPLESS PEDALS: Modern pedals that don't use toe-clips and connect to the shoe cleat

CRANK: The metal (sometimes carbon) arm with the pedals and chainrings attached

DERAILLEUR (or mech, short for mechanism): Moves the chain between gears at front and rear. The rear mech also tensions the chain and takes up the slack when using a small chainring and small sprocket combination

DH (DOWNHILL): The fastest and arguably most exciting form of mountain biking competition and a big-money sport. DH bikes are heavier and have long travel suspension, radically reclined geometry, and bigger disc brakes

DISHED: Off-centre wheel build to allow for the width of the cassette and centralise the rim

DOWN-TUBE: The diagonal tube from the head-tube to the bottom bracket

DROPOUT: The slot in the frame for the wheel axle to sit in. Horizontal dropouts can be used to tension the chain on singlespeed bikes

DROPS: The lower sections of road handlebars, used to give a more aerodynamic riding position

ENDURO: A longer form of XC race

FREEHUB: The ratchet assembly in the rear hub that allows you to coast without pedalling

GRAVITY ENDURO: Also confusingly referred to as just Enduro. Gravity races take place over a MTB course, but competitive times are only taken from four or five marked descents

HEADSET: These bearings separate the fork from the frame, holding the fork in place while allowing you to steer. Threaded designs use a nut on the fork steerer with a lock-nut on top

HEAD-TUBE: Short front tube usually with the maker's badge on it. Contains the headset, and the fork steerer passes through it

HUB: The centre of the wheel, housing the axle and bearings, joined to the rim by spokes

LBS: Common cycling acronym, especially in web forums, for local bike shop

MECH See 'derailleur'

MTB: Stands for Mountain Bike

NIPPLE: The nut on the end of a spoke, used to tension the spoke and shape the wheel

NORTH SHORE: Narrow wood-boarded paths, usually built through trees, often elevated and with jumps, drops, bank turns, see-saws etc

PINCH FLAT: A puncture caused by the tube getting pinched between the rim and a hard object, usually because of too little air pressure

PRESTA: Long, skinny, screw-in air tube valve, generally preferred to Schrader car-type valves

QUICK-RELEASE: Spring-centred skewer with a cam-action lever at one end and a nut at the other to clamp the wheel in place in one motion. Often used for the seatpost clamp too

RAKE: The angle of the head-tube from horizontal. Dictates steering character

REAR TRIANGLE: The triangle shape made by the seat-tube, seatstays and chainstays

SCHRADER: Car type inner-tube valve, also used on air-sprung suspension

SEAT-TUBE: The upright tube in the centre of the frame into which the seatpost fits. The front mech clamps around bottom of the seat-tube. Meets the down-tube at the bottom bracket

SEATPOST: The post to which the saddle is mounted. Setting the correct height is very important. Available with suspension or height adjustment for light trail or hardcore all-mountain riding respectively

SEATSTAYS: The diagonal tubes on the frame that run from the seat-tube to meet the chainstays at the rear dropouts. Can look radically different on full suspension bikes

SPOKES: Connect the wheel hubs to the wheel rims. More spokes are used in stronger wheels. Road wheels use fewer spokes and sometimes blade-shaped spokes for aerodynamics

SPORTIVE: Timed, but non-competitive, long distance, mass-start road ride, usually hilly and sometimes mountainous, especially in Europe

STEM: Connects the handlebars to the fork steerer. Stems come in lots of lengths and angles to suit different riding styles

TIME TRIAL: A road race against the clock over a set standard distance eg 10, 25, 50 miles, or a set time eg 12 or 24hrs.

TOP-TUBE: Connects the head-tube to the seat-tube, used to be called the crossbar

TRUE: When a wheel is precisely round with no deformity sideways or vertically

TUBELESS: MTB tyre system that seals and inflates like car tyres with no tubes to puncture

TUBULAR: A light racing road tyre with the tube and tread as one. Needs specific wheel rim

XC (CROSS-COUNTRY): Mountain bike riding on natural or semi-natural terrain. Circuits typically avoid steep decents, but may have climbs

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Tel 0207 150 5000 (London)
Tel 0117 927 9009 (Bristol)
www.immediatemedia.co.uk

Printed in the UK by William Gibbons on behalf of Immediate Media Company
Distributed in the UK by Seymour Distribution Ltd (London).
Tel: 020 7429 4000

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